FINAL REPORT

Interim Record of Decision Operable Unit 1

Hanscom Air Force Base Massachusetts

Prepared for
HQ AFCEE/ERD

Brooks AFB, TX 78235-5328
November 2000

Contract No. F41624-97-D-8019
Delivery Order 0028

Prepared by
CH2MHILL

25 New Chardon Street, Suite 500
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DEPARTMENT OF ENVIRONMENTAL PROTECTION
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December 27, 2000

Mr. Thomas Best, Engineer
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120 Grenier Road
Hanscom Air Force Base
Bedford, MA 01731-1910

RE: RTN 3-0223 Hanscom Air Force Base – BEDFORD
Record of Decision, Operable Unit 1
State Concurrence to Interim Record of Decision

Dear Mr. Best:

The Department of Environmental Protection (DEP) has received the Interim Record of Decision (ROD) Final Report for Operable Unit 1 (OU1). We have reviewed the document and found it to be consistent with the remedy parameters established in the June 2000 Proposed Plan.

We have reviewed and accepted the comments provided by the U.S. Environmental Protection Agency on the ROD and the comments and responses resulting from the June 20, 2000, Public Hearing. DEP has also reviewed the Applicable and Relevant or Appropriate Requirements (ARARs) and found them to be consistent with the remedy selection and protective of human health and the environment.

DEP concurs with the overall objective of the Interim ROD, with the interim cleanup goal of achieving drinking water standards, and with the selected remedy. DEP appreciates the opportunity to comment on the OU1 Interim ROD. If you have any questions about this letter, please contact the Project Manager, Robert Campbell, at (617) 292-5732.

Sincerely,

Deirdre C. Menoyo

Deirdre C. Menoyo
Assistant Commissioner
Bureau of Waste Site Cleanup

Cc: Mike Barry, EPA
David Black, Board of Health, Town of Bedford
Elizabeth Bagdonas, Conservation Commission, Town of Bedford

Appendix E – MADEP Concurrence Letter

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13. ABSTRACT *(Maximum 200 words)*

This report presents the Final Interim Record of Decision for Hanscom AFB, Massachusetts Operable Unit 1. The Final Interim Record of Decision summarizes the phases of site investigation, human health and ecological risk assessments, and Focused Feasibility Study and presents the selected alternative for remedial action to address contamination risk at the site.

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Acronyms

AFB	Air Force Base
ARAR	Applicable or Relevant Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Act Information System
cfs	Cubic feet per second
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CSM	Conceptual Site Model
ERA	Ecological Risk Assessment
ERAM	Ecological Risk Assessment Methodology
ESC	Electronics Systems Center
ESD	Explanation of Significant Differences
FAA	Federal Aviation Administration
gpm	gallons per minute
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
LTSP	Long Term Sampling Program
MADEP	Massachusetts Department of Environmental Protection
MASSPORT	Massachusetts Port Authority
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
mgd	million gallons per day
MSL	mean sea level
NCP	National Oil and Hazardous Substances Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OSRR	Office of Site Remediation and Restoration
R&D	Research and Development
RAB	Regional Advisory Board
RAO	Remedial Action Objectives
RfD	Reference Dose
ROD	Record of Decision
PAH	Polynuclear Aromatic Hydrocarbon
PPE	Personal Protective Equipment
SACM	Superfund Accelerated Cleanup Model
SARA	Superfund Amendments and Reauthorization Act
SVOC	Semi-volatile organic compound
TRC	Technical Review Commission
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile organic compound

1.0 Declaration for the Interim Record of Decision (IROD)

Hanscom Field/ Hanscom Air Force Base
CERCLIS ID#: MA8570024424
Operable Unit 1
Bedford and Concord, Massachusetts

1.1 Statement of Basis and Purpose

This decision document presents the selected remedial action for Operable Unit 1 (OU-1), at Hanscom Air Force Base (AFB). This remedial action was selected in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 USC § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 et seq., as amended. The Director of the Office of Site Remediation and Restoration (OSRR) has been delegated the authority to approve this IROD.

This decision was based on the Administrative Record, which has been developed in accordance with Section 113 (k) of CERCLA, and which is available for review at the Hanscom AFB Environmental Flight Office located at 72 Dow Street, Hanscom AFB. The Administrative Record Index (Appendix A to the IROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The Commonwealth of Massachusetts, through the Massachusetts Department of Environmental Protection (MADEP), concurs with the selected remedy.

1.2 Assessment of the Site

The response action selected in this IROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. This IROD also acts as the decision document for choosing No Further Action for soils at Sites 5 and 20 at OU-1. Groundwater beneath Sites 5 and 20 will be monitored as part of the OU-1 plume.

1.3 Description of the Selected Remedy

This IROD sets forth the selected remedy for OU-1 at the Hanscom AFB site, which involves the continued operation of the existing dynamic groundwater collection and treatment system, the implementation of institutional controls, and the monitoring of groundwater and surface water. This remedy is expected to effectively contain the migration of

groundwater contaminants and is expected to reduce the overall extent of the groundwater plume via a reduction in contaminant mass. This remedy is intended to be an interim remedial action. Additional information will be gathered to support a final remedy that will be targeted at remediating all or part of the groundwater plume. This IROD also acts as the decision document for choosing No Further Action for soils at Sites 5 and 20 at OU-1.

The following are the major components of the selected remedy:

- Continuing to operate the existing groundwater recovery and treatment system (groundwater collection trenches, interceptor wells, vacuum enhanced recovery wells, and a groundwater treatment plant) at OU-1 and adjusting performance by optimizing pumping and recovery well locations as necessary.
- Continuing an environmental sampling program (including groundwater and surface water) to monitor the performance of the groundwater recovery and treatment system and to monitor the impacts to ecologically-sensitive areas.
- Continuing to look for effective measures to reduce source area contamination in order to expedite groundwater cleanup.
- Implementing institutional controls [through both the Base Comprehensive Land Use Plan for Hanscom AFB and memoranda of understanding with the Massachusetts Port Authority (MASSPORT) and the Town of Bedford] to prevent exposure to and use of contaminated groundwater and to ensure that future land uses do not allow exposure to residual subsurface soil contamination in the groundwater plume source areas.
- Conducting Five-Year Reviews to ensure that the cleanup remedy continues to protect human health and the environment.

The selected remedy is a comprehensive approach for this operable unit that addresses current and potential future risks caused by groundwater and soil contamination. Specifically, this remedial action addresses five distinct areas of concern, within OU-1, known as Installation Restoration Program (IRP) Sites 1, 2, 3, 5, and 20, which are all located on Hanscom Field. Remedial actions have already been conducted in confirmed plume source areas within OU-1 (IRP sites 1, 2 and 3 which are summarized in Section 2.2). The nature of contamination at OU-1 includes dissolved-phase volatile organic compounds (VOCs) and residual soil contamination in plume source areas. Dense non-aqueous phase liquid (DNAPL) has been found at the Site 1 and is suspected to be present at other locations within OU-1. Principal chemicals of concern include trichloroethylene (TCE), cis 1,2-dichloroethylene (DCE), and vinyl chloride in groundwater. The contamination is a result of various historical airfield maintenance and training activities. Principal threats that this IROD addresses include human contact with contaminated soil and ground water and human ingestion of contaminated groundwater.

The primary objectives of the interim remedial measures – continued operation of the existing dynamic groundwater treatment system combined with institutional controls and monitoring – are to prevent the migration of contaminants in the groundwater, prevent the discharge of contaminants from the groundwater to surface water bodies, and prevent human exposure to groundwater above health-based criteria via ingestion, inhalation and dermal contact. Limited, secondary objectives are to decrease the mass of contaminants

near the source areas (potentially including DNAPL), and to reduce the size of the off-base dissolved phase plume (i.e., draw the plume back toward the source areas). While contaminated soil remedial measures are not stated objectives of this interim remedial action, institutional controls being implemented will also prevent human exposure to residual subsurface soil contamination in the plume source areas

This OU is one of four at Hanscom AFB. The United States Air Force (USAF) began implementing the IRP at Hanscom AFB during the 1980s with initial surveys and records reviews to identify potentially contaminated sites. Hanscom AFB, including Hanscom Field, was listed on the USEPA National Priorities List (NPL) in 1994. Of the 22 individual IRP sites with known or suspected contamination, 9 have been designated as CERCLA sites and fall under jurisdiction of the USEPA. The sites were grouped into four operable units. Operable Unit 1 includes IRP Sites 1, 2, 3, 5 and 20.

The selected response action addresses principal threats wastes at OU-1 by preventing the further migration of contaminated groundwater off of Hanscom Field/Hanscom AFB property (e.g., into the Town of Bedford Forest), removing contaminant mass near the source areas, undertaking long-term monitoring, and implementing institutional controls to prevent contact with contaminated groundwater and with residual subsurface soil contamination in the plume source areas.

1.4 Statutory Determinations

This interim action is protective of human health and the environment in the short term and is intended to provide adequate protection until a final ROD is signed; complies with (or waives) those federal and state requirements that are applicable or relevant and appropriate for this limited-scope action; and is cost-effective. Because this action does not constitute the final remedy for OU-1, it is not intended to address the statutory mandate for utilizing permanent solutions to the maximum extent practicable. It does not provide permanent aquifer restoration but rather is primarily an interim containment remedy with institutional controls to prevent exposure to contaminated media and with limited, secondary objectives of source area contaminant mass removal and plume capture and treatment. In addition, although this interim action uses treatment to reduce contaminant toxicity, mobility and volume, the statutory preference for remedies that employ treatment to reduce contaminant toxicity, mobility or volume will be more fully addressed by the final remedy. Subsequent actions will address fully the threats posed by conditions at this operable unit.

Because this remedy will result in hazardous substances remaining on-site above levels that allow unrestricted exposure and unlimited use, and groundwater and land use restrictions are necessary, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within five years after commencement of the remedial action. Five year reviews are not necessary for the soils at the No Further Action Sites 5 and 20. Groundwater beneath Sites 5 and 20 will continue to be monitored as part of the OU-1 plume. Because this is an interim action ROD, review of this site and remedy will be ongoing as Hanscom AFB continues to develop remedial alternative for the site.

1.5 Special Findings

Issuance of this IROD embodies specific determinations made by the Regional Administrator pursuant to CERCLA. Under section 121(d)(4)(A) of CERCLA, the Regional Administrator concurs with the decision to waive attainment of the following applicable or relevant and appropriate requirements (ARARs) within the groundwater plume on the basis that this action is an interim measure and will become part of a total remedial action that will meet or attain ARARs when it is completed: the federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), the SDWA Maximum Contaminant Level Goals, the Massachusetts Drinking Water Standards, and the Massachusetts Contingency Plan (MCP) Method 1 GW-1 groundwater standards. Due to the nature of OU-1, full compliance with these requirements will not be attained in the existing groundwater contaminant plume in the short-term. However, pursuant to this IROD, captured groundwater will be treated to below these standards prior to discharge and long-term monitoring of groundwater and surface water will be conducted to track changes in contaminant concentration over time.

1.6 IROD Data Certification Checklist

The following information is included in the Decision Summary section of this IROD. Additional information can be found in the Administrative Record file for this site.

1. Chemicals of concern (COCs) and their respective concentrations
2. Baseline risk represented by the COCs
3. Cleanup levels established for COCs and the basis for the levels
4. Current and future land and ground-water use assumptions used in the baseline risk assessment and IROD
5. Land and groundwater use that will be available at the site as a result of the selected remedy
6. Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected
7. Decisive factor(s) that led to selecting the remedy

1.7 Authorizing Signatures

This IROD documents the selected remedy for groundwater at OU-1 at Hanscom AFB. This remedy was selected by the Air Force with concurrence of the USEPA and the MADEP.

U.S. Air Force

By: Robert H. Latiff Date: 24 Jan 2001

ROBERT H. LATIFF
Brigadier General, USAF
Vice Commander
Electronic Systems Center

U.S. Environmental Protection Agency

By: Patricia L. Meaney Date: 6 Feb. 2001

Patricia L. Meaney
Director
Office of Site Remediation and Restoration
Region 1

2.0 Decision Summary

2.1 Site Name, Location and Brief Description

2.1.1 Name and Location

Hanscom Field/Hanscom AFB – This site is located in Middlesex County, Massachusetts, approximately 14 miles northwest of downtown Boston and includes land in the towns of Bedford, Concord, Lexington, and Lincoln, Massachusetts. The OU-1 area, addressed in this IROD, includes parts of Hanscom Field, Hanscom AFB and the wetland and forest areas to the north/northeast of the runways that is owned by the Town Of Bedford (Figure 2-1).

2.1.2 Comprehensive Environmental Response, Compensation, and Liability Act Information System Identification Number

The Comprehensive Environmental Response, Compensation and Liability Act Information System (CERCLIS) identification number for Hanscom Field/ Hanscom AFB is CERCLIS ID# MA8570024424.

2.1.3 Lead Agency

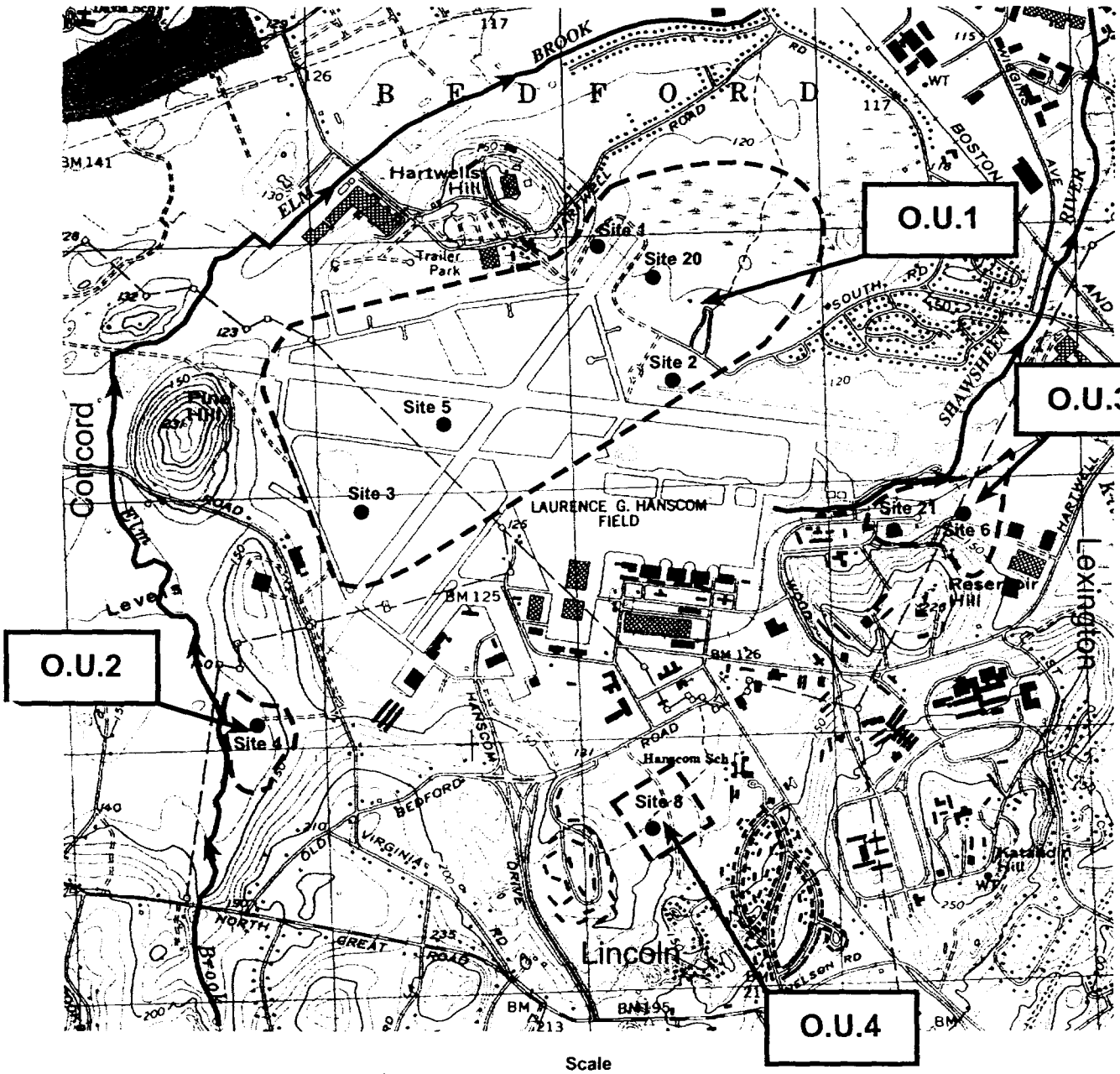
The USAF is the lead agency with regulatory oversight from USEPA (lead) and the MADEP (support).

2.1.4 Site Description

Hanscom AFB is an active base owned and operated by the Federal government through the Department of the USAF. Hanscom AFB is home to the Electronics Systems Center (ESC), a dynamic nucleus of research and development. ESC is the USAF acquisition and development center for world-class command and control systems.

Hanscom Field, located adjacent to and north of the Base, is a civilian airport owned by the Commonwealth of Massachusetts and operated by MASSPORT and the Federal Aviation Administration (FAA). However, Hanscom Field was used as a military airport by the Air Force from 1942 to 1973.

Topographically, Hanscom AFB is located in a low-lying basin surrounded by hills. The relatively flat runway portion of Hanscom Field lies in the ancient lake bed of glacial lake Concord. The ground surface elevation on this former lake bed ranges from 120 to 130 feet above mean sea level (MSL). The hills south of the air base, and Pine Hill to the west, rise to more than 200 feet MSL. Hills north of the airfield area are more subdued, but still rise above 150 feet MSL. Former Glacial Lake Concord, and Hanscom AFB on its southern edge, drain to the Shawsheen River, which flows north-northeast from the site to join the Merrimack River approximately 15 miles downstream.



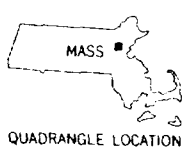
Scale

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

CONTOUR INTERVAL 10 FEET



QUADRANGLE LOCATION

LEGEND
Town Boundary

N

Source:
. Geological Survey Topographical Map
ıcord, Massachusetts 1970, Photorevised 1979

Figure 2-1
Vicinity Map
Operable Units
Hanscom AFB, MA

CH2MHILL

The Department of Defense (DoD) initiated its IRP concurrently with CERCLA (as amended by SARA) with the overall goal of cleaning up contamination on installations. The USAF began implementing the IRP at Hanscom AFB during the 1980s with initial surveys and records reviews to identify potentially contaminated sites. Hanscom AFB, including Hanscom Field, was listed on the USEPA National Priorities List (NPL) in 1994. Of the 22 individual IRP sites with known or suspected contamination, 9 have been designated as CERCLA sites and fall under jurisdiction of the USEPA. The CERCLA sites were grouped into four operable units, defined as follows:

Operable Unit 1

- IRP Site 1: Fire Training Area II
- IRP Site 2: Paint Waste Disposal Area
- IRP Site 3: Jet Fuel Residue/Tank Sludge Disposal Area
- IRP Site 5: Fire Training Area I
- IRP Site 20: Suspected Fire Training Site

Operable Unit 2

- IRP Site 4: Sanitary Landfill

Operable Unit 3

- IRP Site 6: Landfill/Former Filter Beds
- IRP Site 21: Unit 1 Petroleum Release Site

Operable Unit 4

- IRP Site 8: Scott Circle Landfill

The location of the four Operable Units is shown in Figure 2-1. A more complete description of the site can be found in Section 1.3 – Background Information of the Focused Feasibility Study, Operable 1, Hanscom AFB, Massachusetts (CH2M HILL, May 2000).

2.2 Site History and Enforcement Activities

2.2.1 History of Site Activities

Prior to 1973, Hanscom AFB leased the runways and flight line, that are now Hanscom Field, from the Commonwealth and the primary mission of Hanscom AFB was the operational maintenance of fighter aircraft and research and development (R&D) support.

During the period that the Air Force leased the runways and flight line, hazardous wastes were generated by support operations and disposed of at different areas on Hanscom Field. In addition, fire training exercises were routinely conducted at one or more areas on Hanscom Field. As noted above, OU-1 includes IRP Sites 1, 2, 3, 5 & 20 (Figure 2-1) which are all located on Hanscom Field and for which the Air Force is the principal responsible party (PRP).

2.2.1.1 Site 1 - Fire Training Area II

Site 1, located at the north end of the airfield (Figure 2-1), was reportedly used from the late 1960s through 1973 for fire training exercises. Waste oils, solvents, paint thinners, and degreasers were collected from around the base, dumped into pits, ignited, and then extinguished. Occasionally, aircraft wrecks and fuselages were burned in the pits. The size

of the pits was estimated to be 15 feet by 20 feet. There is no information indicating that a liner or containment was used at this source.

2.2.1.2 Site 2 - Paint Waste Disposal Area

Site 2, located in the northeast portion of the airfield, was used for disposing of waste solvents and paint from 1966 to 1972 (Figure 2-1). Metal plating wastes may also have been disposed in this area from the early 1960s through 1972. There is no information indicating whether any type of liner or containment was used in this area.

2.2.1.3 Site 3 - Jet Fuel Residue/Tank Sludge Disposal Area

Site 3 is located at the western portion of the airfield (Figure 2-1). Several hundred drums of waste airplane fuels, oil, and paint were buried at Site 3 between 1959 and 1969. Leaking drums were reported at Site 3 at the time of burial. There is no information indicating whether any type of liner or containment was used in this area.

2.2.1.4 Site 5 - Fire Training Area I

According to the IRP Records Search Report this was Hanscom AFB's original fire training area. This report stated that during the early 1950s through the 1960s, Fire Training Area 1 (Figure 2-1) consisted of a large pit which was used to dispose of and ignite drums of flammable materials. Historical information collected by Haley & Aldrich, Inc. (H&A) during a following investigation did not support the findings of a fire training area at the reported location. A review of plans and areal photographs from the 1950s and 1960s does not depict an open pit at the location. Instead, these photographs portray a taxiway across much of the reported location of the fire training area. H&A's soil and groundwater sampling of this area also provided no evidence that a large pit containing drums of flammable materials existed at Site 5, as reported in the Records Search Report. It was concluded that, if fire training exercises were performed in this area, it is more likely that they were performed on a small scale. Based on the results of H&A's investigation, no further action is appropriate for Site 5 soils and no evaluation of remedial activities for Site 5 was performed in the Focused Feasibility Study (FFS).

2.2.1.5 Site 20 - Suspected Fire Training Area

In January 1990, a Bedford resident and retired flight line worker reported that a fire training area located east of Runway 23 was used briefly for two months to train fire-fighting crews (Figure 2-1). Law Environmental, Inc. was retained to perform a site investigation to determine if there was any contamination at this site. This investigation did not find a "source" area of contamination but did find evidence of groundwater contamination which may have migrated from IRP Site 1 located approximately 1,000 feet to the northwest on the other side (west) of Runway 23.

Additional investigations were conducted in December 1995 to verify that a source of contamination did not exist in the area reported to have been used for fire training. The 1995 investigation included an extensive soil gas survey and groundwater sampling. This investigation, in conjunction with the Law Environmental investigation, support the finding that, if the fire training area existed, its remnants are not a significant source of groundwater contamination. Also the groundwater and solute transport models included in the FFS

indicate that the groundwater contamination at the reported Site 20 location has migrated from IRP Site 1.

Based on this information, no further action is appropriate for Site 20 soils and no evaluation of remedial activities for Site 20 was performed in the Focused Feasibility Study (FFS).

2.2.2 History of Federal and State Investigations and Removal and Remedial Actions

The Air Force is the responsible party for all sites at OU-1. DoD initiated its IRP concurrently with the CERCLA (as amended by SARA) with the overall goal of cleaning up contamination on installations. The USAF began implementing the IRP at Hanscom Field/Hanscom AFB in 1982 when Roy F. Weston, Inc. was retained by Hanscom AFB to conduct a hydrogeologic investigation at Hanscom Field to assess the potential for water quality degradation at the Town of Bedford's Hartwell Road wellfield as related to past waste disposal activities at Hanscom field. In 1984 JRB Associates, Inc. was retained by Hanscom AFB to complete an Installation Assessment/Records Search. The purpose of this investigation was to identify the potential for environmental contamination from past waste management practices, evaluate the probability of contaminant migration, and assess the potential hazard posed by past disposal activities. This effort identified 13 specific sites to be included in the restoration program. Subsequent discoveries have increased the number of IRP sites to 22. In 1985 Haley & Aldrich, Inc. (H&A) was retained by Hanscom AFB to conduct investigations and prepare Remedial Action Plans for Sites 1 through 5 on Hanscom Field. Subsequently, in 1988, the Final Remedial Action was completed for the closed base municipal landfill (Site 4) and Removal Actions (removal of buried drums and/or contaminated soil) were completed at three high risk sites on L.G. Hanscom Field (see Sites 1, 2 & 3 below). The above investigations, Remedial Action Plans and Removal Actions were conducted under the Air Force initiated CERCLA based IRP with the MA DEP as the lead regulatory agency.

In August 1996, in order to determine the magnitude and extent of any residual soil contamination at the confirmed OU-1 plume source areas (Sites 1, 2 and 3), Hanscom AFB partnered with USEPA and Tufts University on a soil sampling program under CERCLA. For Hanscom AFB, the purpose of the soil sampling and analysis was to determine if residual soil contamination warranted additional remedial efforts. The data also was used to evaluate the effectiveness of response efforts to date. More details on the results of this soil sampling and analysis are provided in CH2M HILL's Final Report dated 19 January 1998, entitled: *OU-1 Field Report, Hanscom AFB.* For USEPA and Tufts the soil sampling and analysis program was part of USEPA's Environmental Technology Initiative (ETI). This ETI project was the demonstration of a dynamic site investigation using Adaptive Sampling and Analysis with the goal of demonstrating the capability of field analytical technologies in the context of producing data of sufficient quality to support remedial decisions in a cost-effective manner. USEPA published the results of this effort as USEPA document USEPA-542-R-98-006, dated September 1998, entitled: *Innovations in Site Characterization, Case Study: Hanscom Air Force Base, Operable Unit 1 (Sites 1, 2 and 3).*

2.2.2.1 Site 1 - Fire Training Area II

Three areas where contaminated soils were excavated at Site 1 in 1988 include: Burn Pit #1, Burn Pit #1 Runoff Area, and Burn Pit #2. A total of 2,160 tons of visibly contaminated soil was removed and transported to disposal facilities. Post-excavation survey data indicate that excavation depths averaged three to four feet in the two Burn Pits, and one to two feet in the Burn Pit #1 Runoff Area. These areas were backfilled with clean fill material.

2.2.2.2 Sites 2 & 3 - Paint Waste Disposal Area Jet Fuel Residue/ Tank Sludge Disposal Area

Buried drums were excavated from Sites 2 and 3 in January and February, 1988. The majority of the drums were empty and only 660 gallons of liquids were recovered. Site 2 contained 4 drum excavation pits and Site 3 contained 10 drum excavation pits. A total of 1,896 tons of visibly contaminated soil was removed from the pits along with the drums and transported to licensed off-site disposal facilities. The pits were backfilled with the remaining excavated soil with the intent that any residual contamination would be captured by the groundwater collection trench installed around the perimeter of the site.

2.2.2.3 Site 5 – Fire Training Area I

The H&A field investigations provided no evidence for drum disposal or large scale fire training exercises. Based on the results of the field investigation, no significant contamination was detected at Site 5. As a result, no further action was performed at this location, although additional groundwater samples have been collected from the Site 5 area for analysis as part of the long term monitoring program for Area 1 (now OU1). H&A subsequently prepared a "Remedial Action Plan for Site 3/5" dated May 1988. However, this required no action for Site 5 except for groundwater monitoring.

H&A was also retained to prepare a "Decision Document for Close-Out" for Site 5. This document, signed by the Base Commander on 27 September 1991, includes the declaration that "... the selected remedy is no action and the site is hereby closed-out." Upon Hanscom AFB/Hanscom Field's addition to the NPL in May 1994 EPA reviewed the IRP files and advised that this site was considered under the purview of CERCLA and would be included in Operable Unit 1. Based upon subsequent discussions with EPA, no source removal actions will be required for Site 5, and any residual groundwater contamination will be captured by the existing OU-1 groundwater collection and treatment system. Therefore, this IROD serves as the decision document declaring that no further action is appropriate under CERCLA in regard to soils at Site 5. Groundwater beneath Site 5 will be monitored under the selected remedy as part of the OU-1 plume.

2.2.2.4 Site 20 – Suspected Fire Training Area

In January 1990, a Bedford resident and retired flight line worker reported that a fire training area located east of Runway 23 was used briefly for two months to train fire-fighting crews. This area is on Hanscom Field (MASSPORT property) and is within the boundaries of Operable Unit 1.

Law Environmental, Inc. was retained to perform a site investigation under the MCP to determine if there was any contamination at this site. This investigation did not find a "source" area of contamination but did find evidence of groundwater contamination which may have migrated from IRP Site 1 located approximately 1,000 feet to the northwest on the

other side of Runway 23. EA Engineering, Science, and Technology, Inc. was retained to evaluate Law's findings. Their conclusion was that "Based on the information provided for review, a No Further Action remedy is recommended for this site in regard to petroleum hydrocarbons and lead detected in the soil beneath the Fire Training Area (FTA)".

Upon Hanscom AFB Hanscom Field's addition to the NPL in May 1994 EPA reviewed the IRP files and advised that this site was considered under the purview of CERCLA and that the site would be included in Operable Unit 1. Additional investigations were conducted in December 1995 under CERCLA to verify that a source of contamination did not exist in the area reported to have been used for fire training. The 1995 investigation included an extensive soil gas survey and groundwater sampling.

The 1995 investigation, in conjunction with the Law Environmental investigation, support the finding that, if the fire training area existed, its remnants are not a significant source of groundwater contamination. Also the groundwater and solute transport models included in the FFS indicate that the groundwater contamination at the reported Site 20 location has migrated from IRP Site 1. Therefore, this IROD serves as the decision document declaring that no further action is appropriate under CERCLA in regard to soils at Site 20. Groundwater beneath Site 20 will be monitored under the selected remedy as part of the OU-1 plume.

2.2.2.5 Response Actions for OU-1 Groundwater

Groundwater beneath OU-1 is contaminated with volatile organic compounds (VOCs) as the result of past disposal activities. As part of the Remedial Action Plan developed for Sites 1, 2, and 3/5 by H&A in 1988 with MA DEP as the lead regulatory agency, a groundwater collection and treatment system was constructed to address the OU-1 groundwater contamination. This system was placed in continuous operation in April 1991. The system consists of groundwater collection trenches at Site 1, 2, and 3 and four boundary interceptor wells aligned along a transect near Sites 1 and 2 and the northeast boundary of Hanscom Field and the Bedford Town Forest (Figure 2-2). In 1997 under CERCLA, a Vacuum Enhanced Recovery (VER) system consisting of four recovery wells was placed in operation in the immediate vicinity of Site 1. Also in 1997 under CERCLA, two additional conventional interceptor wells were placed in operation, one downgradient (southeast) of Site 1 and the other downgradient (north) of Site 2. In 1999 under CERCLA, an additional conventional interceptor well was installed at Site 1 and the VER system at Site 1 was augmented by the conversion of 3 monitoring wells in the immediate area to conventional interceptor wells.

All of the collected groundwater is pumped to a central treatment facility located between Sites 1 and 2, and treated water is either recharged back into the ground at Site 2 and/or Site 3 and/or discharged into a drainage channel on the east side of Runway 5-23. The drainage channel discharges into the wetlands (hereafter designated as "Wetland B") and beaver pond area northeast of Runway 5-23. The OU-1 system has treated between 100 to 320 gallons per minute since it became operational and, as of 31 March 2000, one billion gallons of groundwater had been treated.

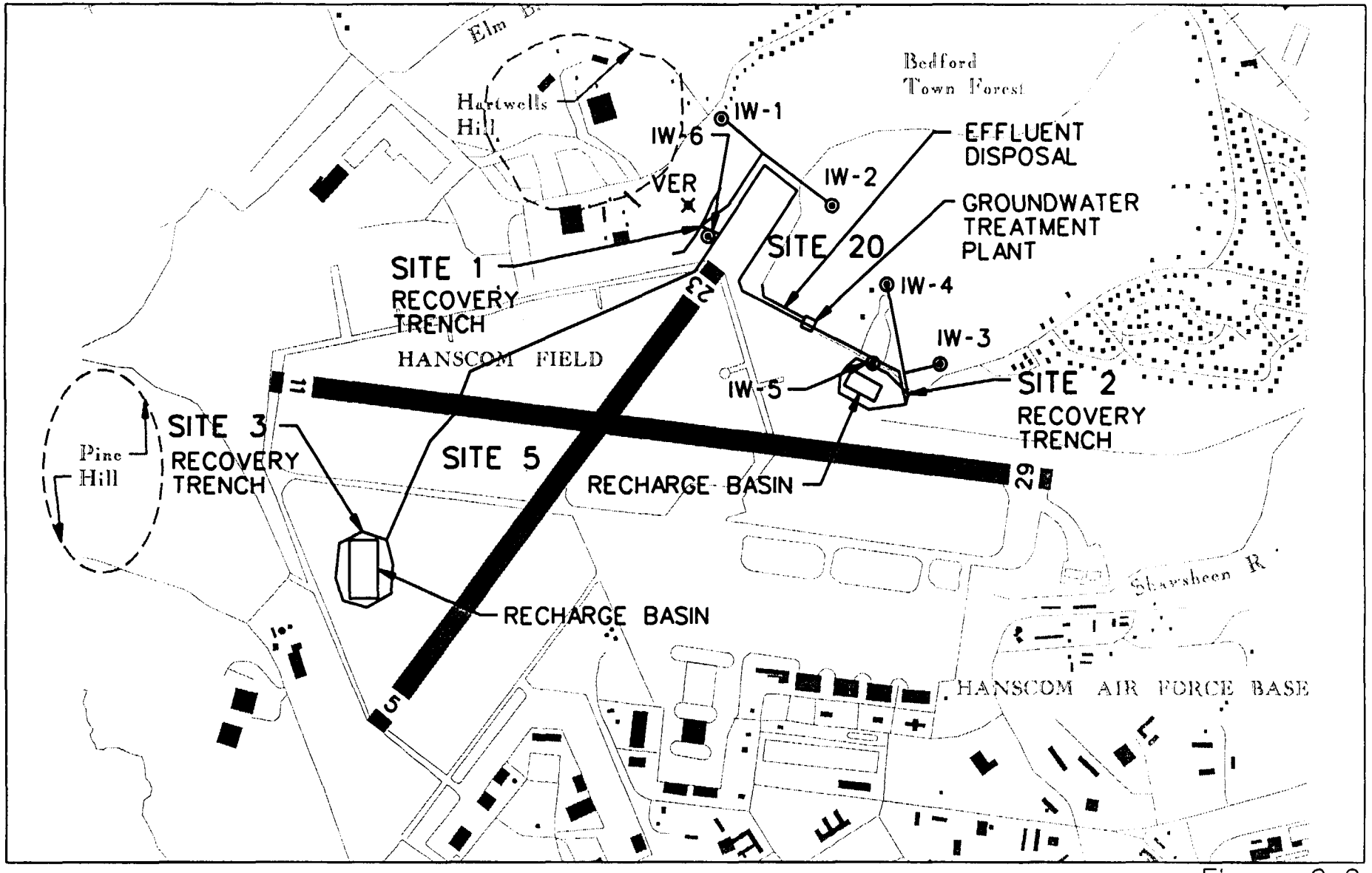


Figure 2-2
OU-1 IRP SITES AND EXISTING GROUDWATER REMEDIATION SYSTEM
HANSCOM AIR FORCE BASE
OPERABLE UNIT 1

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31-OCT-2000 6727f263.dgn

2.2.3 History of CERCLA Enforcement Activities

Hanscom AFB, including Hanscom Field, was listed on the NPL in May 1994. Of the 22 IRP sites with known or suspected contamination, 11 are excluded from the purview of CERCLA under CERCLA's petroleum exclusion clause and have been deferred to the state for regulation under the Massachusetts Superfund Law. Two of the IRP sites were considered closed-out and the remaining 9 IRP sites were grouped into four operable units. OU-1 consists of IRP Sites 1, 2, 3, 5, and 20.

When Hanscom AFB was designated a NPL site in May 1994 it became regulated under CERCLA rather than the Massachusetts Contingency Plan (MCP). The Commonwealth of Massachusetts has determined that the site is "Adequately Regulated" and defers to the federal requirements. In 1994, a comprehensive program was initiated to continue the ongoing remediation while addressing the issues raised by the NPL designation. In 2000, Hanscom AFB and USEPA Region 1 conducted and concluded Federal Facility Agreement (FFA) negotiations. The FFA will establish goals and responsibilities among the USAF and USEPA and will set enforceable cleanup schedules. A couple remaining issues of national significant are being resolved at the Headquarters level at this time. The state has declined to participate in the FFA.

2.3 Community Participation

Throughout the site's history, community concern and involvement have been high. Hanscom AFB has kept the community and other interested parties apprised of site activities through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of public outreach efforts.

- In the early 1980s, public briefings were periodically conducted during Hanscom Field Advisory Commission meetings regarding the Preliminary Assessment/Site Inspection phases of the CERCLA process.
- In the early 1980s, there was significant newspaper coverage of Hanscom AFB's Preliminary Assessment/Site Inspection/Remedial Action status.
- On June 30, 1987 a public informational meeting was held regarding the Remedial Action Plans for Site 1 through 5 at OU-1.
- On April 4, 1989, the Massachusetts Division of Water Pollution Control, Department of Environmental Quality Engineering, Executive Office of Environmental Affairs, provided the State Secretary with a copy of the public notice for a groundwater discharge permit determination for publication in the Central Register. Also on April 4, 1989 the Division of Water Pollution Control requested that the Bedford Minuteman newspaper publish a legal notice concerning Hanscom AFB's groundwater discharge permit application.
- On March 21, 1990, a copy of an Application for Variance and Environmental Notification Form was sent to the regulators and other stakeholders.
- On June 4, 1990 a consultation session was held regarding OU-1 groundwater remediation.

- Technical Review Committee (TRC) meetings were conducted on June 1, 1993 and December 15, 1993.
- The TRC was expanded to become the Restoration Advisory Board (RAB) which has held meetings periodically since November 29, 1994.
- Throughout the CERCLA process the administrative record has been available for public review at the Hanscom AFB Environmental Flight Office, Hanscom AFB. This is the primary information repository for local residents and is kept up to date by Hanscom AFB.
- On May 18, 2000 the project team (Hanscom AFB, USEPA, and MADEP) held a meeting with Bedford Town officials to discuss the Proposed Plans for OU-1 and OU-3/Site 6, the Federal Facility Agreement currently being established between Hanscom AFB and the USEPA, and the situation concerning monitoring well RAP1-7 in the Bedford Community Gardens.
- On June 8, 2000, copies of the Fact Sheet describing the Proposed Plan and information of the public comment period, public meeting, and public hearing were mailed to everyone on the RAB mailing list.
- On June 8, 2000, copies of the Proposed Plan and associated Fact Sheet and information regarding the public comment period, public meeting, and public hearing were mailed to the Town of Bedford and Concord (Town Manager, Board of Health, and Conservation Commission) and MASSPORT (Hanscom Field Manager and Environmental Unit).
- On June 8, 2000, Hanscom AFB and USEPA published a notice and brief analysis of the Proposed Plan in the local and Hanscom AFB newspapers and made the plan and associated Fact Sheet available to the public at the Bedford and Lexington Town Libraries, and the Hanscom AFB Library. The notice included the time and date of the public meeting and hearing.
- From June 9 to July 10, 2000, Hanscom AFB and USEPA held a 30 day public comment period to accept public comment on the alternatives presented in the Feasibility Study and Proposed Plan.
- On June 28, 2000, Hanscom AFB and USEPA held an informational meeting at the Bedford Town Hall to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Feasibility Study and to present the Air Force's Proposed Plan to a broader community audience than those that had already been involved at the site. It should be noted that the fact that the Air Force was seeking an ARARs waiver on the grounds that the selected remedy is an interim action was announced to the public in the Proposed Plan. At this meeting, representatives from USEPA and Hanscom AFB responded to questions from the public.
- On June 28, 2000, Hanscom AFB and USEPA held a public hearing at the Bedford Town Hall to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting and the comments and responses to comments are included in the Responsiveness Summary (Appendix B).

2.4 Scope and Role of Response Action

As stated in Section 2.1.4 and as shown on Figure 2.1 Hanscom AFB CERCLA sites have been grouped into 4 OUs. This IROD addresses OU-1 and is considered necessary to bring the previous remedial actions into CERCLA with USEPA as the lead regulatory agency since the remedial actions conducted in the late 1980s/early 1990s were with MADEP as the lead regulatory agency. USEPA accepted the Remedial Action and Long Term Monitoring that had been completed for OU-2 (IRP Site 4, Sanitary Landfill) as the final remedy and a five-year review of the site was completed in 1997. There are two (2) sites associated with OU-3, IRP Sites 6 and 21. The Site 6 Landfill is currently in the ROD finalization and signature process under CERCLA and the CERCLA Feasibility Study is being completed for Site 21, Former Fueling Facilities. USEPA is reviewing the Air Force's No Further Response Action Planned (NFRAP) Decision Document for OU-4 (IRP Site 8, Scott Circle Landfill).

The selected remedy was developed by combining components of different source control and management of migration technologies to obtain a comprehensive approach for site remediation. In summary, the response action will provide protection of human health and the environment by effectively preventing the continued migration of groundwater contaminants and is expected to reduce the overall extent of the groundwater plume via a reduction in the contaminant mass. The site risks associated with exposure to groundwater and soil contamination will be reduced through the implementation of institutional controls.

The remedy of this IROD is intended to be an interim remedial action during which data will be gathered to: (1) evaluate the interim remedy's progress in reducing levels of contaminants near source areas and in reducing the size of the off-site dissolved phase plume; (2) evaluate natural attenuation as a possible final remedy; and (3) assess technical impracticability. The information gathered will aid in the development of a final remedy. The interim action will neither be inconsistent with nor preclude implementation of the final remedy.

The principal threats that this IROD addresses are summarized in Table 2-1. Principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied. Wastes generally considered to be principal threats are liquid, mobile and/or highly-toxic source material.

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that generally are considered to be low-level threat wastes include non-mobile contaminated source material of low to moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or ground water, low leachability contaminants or low toxicity source material. However, there are no low-level threats at OU-1.

TABLE 2-1
Principal and Low-level Threats

Low-level Threats	Medium	Contaminant(s)	Action To Be Taken
None at OU-1	Not applicable	Not applicable	Not applicable
Principal Threats	**Medium**	**Contaminant(s)**	**Action To Be Taken**
Human contact and ingestion	Groundwater from surficial aquifer	VOCs	Continued operation of collection system (trenches), implementation of ICs, and long-term monitoring
Human contact and ingestion	Groundwater from lower aquifer	VOCs	Continued operation of collection system (wells), implementation of ICs, and long-term monitoring
Human contact and ingestion	Groundwater from bedrock aquifer	VOCs	Continued operation of collection system (wells), implementation of ICs, and long-term monitoring
Human contact with source area subsurface soils	Soils in source areas	VOCs	Implementation of ICs

2.5 Site Characteristics

Chapter 1.0 of the Feasibility Study contains an overview of the Remedial Investigation. The significant findings of the Remedial Investigation are summarized below.

2.5.1 Site Overview

2.5.1.1 Regional Climatology

The climatic conditions at the site are generally characterized as being a continental climate somewhat influenced by the Atlantic Ocean to the east. Weather patterns vary considerably on a year to year and daily basis due to the prevailing northeasterly winds (EA, 1994). According to the EA Report, average annual precipitation is 44 inches, average annual snowfall is 56.6 inches, maximum 24-hour precipitation is 8.7 inches, and maximum 24-hour snowfall is 16.5 inches (based on 87 years of record keeping). Evapotranspiration ranges between 22 and 28 inches per year.

2.5.1.2 Topography and Surficial Geology

The topography and surficial geology of the OU-1 area is illustrated in Figure 2-3. Topographically, the central part of the area is a low-lying basin surrounded by hills. The relatively flat runway portion of Hanscom Field lies in the ancient lake bed of glacial Lake Concord. The ground surface elevation on this former lake bed ranges from 120 to 130 feet above MSL. The hills south of the air base, and Pine Hill to the west, rise to more than 200 feet MSL. Hills north of the airfield area are more subdued, but still rise above 150 feet MSL.

0 1 Mile 2 Miles

N

LEGEND

gaf	graded and filled	Qlcl	low stage lake deposits
Qg_2	sand, gravel, and silt	Qs	swamp deposits
Qlcb	lake bottom deposits	Qsg	sand and gravel
Qlch	high stage lake deposits	Qt	till

Source: U.S. Geological Survey Map GQ-331. Surficial Geology of the Concord Quadrangle. Carl Koteff, 1964.

Figure 2-3
TOPOGRAPHY AND SURFICIAL GEOLOGY
Operable Unit 1
Hanscom Air Force Base

CH2MHILL

2.5.1.3 Regional Geology

The bedrock unit underlying most of the Hanscom AFB area is known as the Andover Granite, which is part of the plutonic series of the Nashoba Block. The Andover Granite is characterized by a series of foliated and unfoliated, garnet-bearing, muscovite-biotite granites and pegmatite (Hepburn and Munn, 1984). The northeast portion of Hanscom AFB is underlain by the Assabet Quartz Diorite and the Shawsheen Gneiss. The Assabet Quartz Diorite is part of the Nashoba Block plutonic series and the Shawsheen Gneiss is part of the metamorphosed stratified rock sequence of the Nashoba Block.

The Bloody Bluff fault zone is approximately one mile east of Hanscom AFB. This fault zone forms the southeasterly boundary of the Nashoba Block. Younger and less extensive north-northeast trending faults have been mapped to the north and south of the Hanscom AFB area. These faults likely extend beneath Hanscom AFB.

Erosional and depositional processes active during the Pleistocene glaciation modified the landscape in the region until the final retreat of glacial ice from the area approximately 13,000 years ago. As the ice retreated from the area, glacial meltwaters formed glacial Lake Concord between the ice front to the north and the hills south of Hanscom AFB. Glacial meltwaters transported and deposited sediments within the lake.

In the vicinity of the Hanscom AFB, glacial sediments consist mainly of glacial outwash materials (material deposited by glacial meltwaters), glacial lacustrine deposits formed in glacial Lake Concord, and glacial till deposits formed in contact with glacial ice. The lacustrine deposits are discontinuous since Lake Concord did not submerge the topographically elevated areas. These elevated areas are generally composed of glacial till sediments and bedrock.

Outwash sediments overlie much of the lacustrine deposits. These sediments consist of silts and fine to coarse sands. In addition to the naturally occurring deposits, extensive areas of Hanscom AFB and Hanscom Field have been filled and graded for construction purposes (JRB Associates, 1984).

Glacial till immediately overlying bedrock around Hanscom AFB consists of either a brown or gray coarse to fine sand with some gravel and silt (JRB Associates, 1984). The glacial till unit is relatively thin to absent at the site (Koteff, 1964). Glacial lacustrine (lake bed) sediments in the vicinity of the Hanscom AFB consist mainly of fine sand and silt grading with depth to clayey silts (JRB Associates, 1984). Koteff, 1964, indicated that the lacustrine sediments at Hanscom Field average 25 feet in thickness. These deposits overlie a discontinuous, thin lens of glacial till and in some places directly overlie bedrock.

2.5.1.4 Hydrology

Former Glacial Lake Concord, and Hanscom AFB on its southern edge, drain to the Shawsheen River, which flows north-northeast from the site to join the Merrimack River approximately 15 miles downstream. The river starts just north of State Road 2A (North Great Road), which corresponds approximately to a drainage divide. It flows northward through the main housing and administrative area of Hanscom AFB, sometimes as an open channel and sometimes through culverts. Prior to the construction of the air base, much of the ancient lake bed south of the present runways was wetlands. The air base now has an extensive storm drain network, but there are still isolated wetland areas. After emerging

from culverts north of Katahdin Hill, the Shawsheen River flows as an open stream northward past the east-end of the east-west runway and out of the area to the east and north.

The western and northern portions of the ancient lake bed are drained by Elm Brook. This stream originates just south of State Road 2A, flows northward on the west side of Pine Hill, passes north of Hartwells Hill, and joins the Shawsheen River. Another surface drainage feature not explicitly shown on the topographic maps is in the wetland area east of Hartwells Hill. This wetland, shown as Qs (Quaternary swamp deposits) in Figure 2-3, is part of the Bedford Town Forest. It contains a network of drainage channels that start in a ditch running along the east side of the north end of the runway. The un-named stream then flows to the northeast through the wetlands of the Bedford Town Forest and joins Elm Brook just upstream of its confluence with the Shawsheen River.

In addition to this natural hydrologic process, there are several man-made influences affecting groundwater flow. At present, the strongest artificial influence is the recharge and subsurface drainage associated with the Hanscom AFB groundwater remediation systems at Sites 1, 2, and 3. Each of these sites has a pumped groundwater recovery trench. The remediation systems at Sites 2 and 3 include artificial recharge fields enclosed within the circumferential trenches. These recharge fields, however, are only sporadically used. The Hanscom AFB groundwater remediation system also includes 4 interceptor wells located north of Sites 1 and 2. Together, the trenches and interceptor wells of this system pump 200 to 300 gallons per minute (gpm) of groundwater. There are also smaller groundwater recovery systems operated by the U.S. Navy and by Raytheon Missile systems. These are located on the northwest side of Hartwells Hill, between the hill and Elm Brook. A third potential influence on groundwater flow in the area is the Town of Bedford's Hartwell Road Wellfield. The wellfield, located west of Hartwell Hill, is not currently in operation. However, it has a pumping capacity of approximately 0.82 million gallons per day (mgd), or 570 gpm, which would have an effect on groundwater flow if operation were to resume.

The US Geological Survey (USGS) has established a temporary stream gauging station in the headwaters of the Shawsheen River where it exits from culverts on the north side of Katahdin Hill. Flow records for 1995 and 1996 indicate a minimum flow of about 1.4 cubic feet per second (cfs) at this gauge. This was taken as an estimate of the base flow of the stream at this point. It includes groundwater seepage into the storm drain system under the Hanscom AFB housing and administrative area. Depth to groundwater ranges from 5 to 10 feet below grade surface (bgs) across Hanscom AFB. These drains are observed to flow even when there has been no rain for several weeks.

2.5.1.5 Hydrogeology

Groundwater flow occurs both in the fractured and weathered bedrock under the modeled area and in the unconsolidated sediments above the bedrock. The bedrock is predominantly granite, but some zones of gneiss, schist, and diorite have been encountered. Most borings have encountered numerous fractures, some filled with silt. No predominant direction of fracturing has been identified. Rock Quality Designations range from 10 to 100% with an average of 85%. The majority of the borings penetrated less than 50 feet into bedrock. It is not known how deep into the bedrock that significant groundwater flow persists. A review

of bedrock production wells in the vicinity of Hanscom AFB revealed seven wells with depths of bedrock penetration ranging from 71 feet to 1004 feet.

The unconsolidated sediments from the top of bedrock to the ground surface can best be characterized by distinguishing between the low-lying areas of the glacial Lake Concord basin and the surrounding hills. In the ancient lake bed, the unconsolidated sediments are glacial and lacustrine deposits that form two transmissive zones separated by a semi-confining unit. The lower transmissive zone is in direct contact with the bedrock. It generally includes a sandy glacial till lying directly on the rock surface, and a coarser sand and gravel outwash. The thickness of this unit varies from 0 to 60 feet, pinching out at the bases of the hills. Above this lower aquifer, is a lacustrine silt and clay layer of relatively low hydraulic conductivity. This semi-confining unit is not continuous, as it pinches out at the hills and has been eroded away under Elm Brook just north of Hartwells Hill. Its thickness varies from 0 to more than 50 feet. The upper transmissive zone is a lacustrine sand unit. In some areas this sand is well sorted, and in others it includes grain sizes ranging from very fine sand and silt to fine gravel. The thickness of the lacustrine sand varies from 0 to 30 feet.

The hills are composed of a raised bedrock surface covered with glacial till. In some areas, such as Hartwells Hill, two types of till, sandy till and clayey till, have been identified. The clayey till generally lies directly on the bedrock surface. It is quite dense, and has a lower hydraulic conductivity than the sandy till. Its areal extent is also more limited. The sandy till consists of unsorted sand and silt with varying amounts of clay and gravel. It generally extends to the ground surface in the hilly areas.

2.5.2 Type of Contamination and Affected Media

2.5.2.1 Groundwater Contamination

The nature and extent of groundwater contamination in the three aquifers in the OU-1 area (upper, lower, and bedrock) have been evaluated in detail through the Long-Term Sampling Program (LTSP). Thirteen rounds of sampling within the OU-1 area have been completed since 1986. The LTSP was designed to assess the nature and extent of groundwater contamination and the effects of the OU-1 groundwater collection and treatment system which commenced operation in 1991.

Based on the historical LTSP data, COCs at OU-1 consist of chlorinated and aromatic VOCs, with the contaminants with highest concentrations being trichloroethene (TCE), 1,2-dichlorothene (1,2-DCE) and vinyl chloride. The maximum Round 13/Nov 1999 (or Round 11/May 1998 if Round 13 data is not available) concentration of COCs within each plume source and other OU-1 areas by aquifers is listed in Table 2-2. Dense non-aqueous phase liquid (DNAPL) is known to be present at Site 1 [in the vicinity of the Vacuum Enhanced Recovery (VER) system], and is suspected to be present in other areas within OU-1. However, the extent of the DNAPL is not known.

In order to further evaluate the groundwater contamination within the OU-1 area, CH2M HILL constructed a multi-layer groundwater flow model of the area. This groundwater model formed the basis for the construction of a solute transport model of the OU-1 area (CH2M HILL, 1997). These models are discussed more fully in the FFS report. The groundwater flow and solute transport models are used to facilitate the development of

TABLE 2-2
Contaminants of Concern – OU-1

Contaminant (exceeding MCL)	Sample Id/ Location	Maximum Concentration	MCL (Drinking Water Standard)	Sampling Round/Date
Site 1 Plume Source Area				
Surface & Lower Aquifer				
Trichloroethene	RAP1-3S	150 ug/L	5 ug/L	Round 11/18 May 98
Cis-1,2-Dichloroethene	RAP1-3S	550 ug/L	70 ug/L	Round 11/18 May 98
Bedrock Aquifer				
Trichloroethene	RAP1-3R	477,000 ug/L	5 ug/L	Round 11/18 May 98
Site 1 Plume				
Surface Aquifer None Detected				Round 13/ Oct-Dec 99
Lower Aquifer				
Trichloroethene	RAP1-6T	1,400 ug/L	5 ug/L	Round 13/6 Oct 99
Cis-1,2-Dichloroethene	RAP1-6T	5,100 ug/L	70 ug/L	Round 13/6 Oct 99
Vinyl Chloride	RAP1-6T	1,000 ug/L	2 ug/L	Round 13/6 Oct 99
Tetrachloroethene	B240	16 ug/L	5 ug/L	Round 13/6 Oct 99
1,1Dichloroethane	RAP1-6T	270 ug/L	70 ug/L	Round 13/6 Oct 99
1,1Dichloroethene	RAP1-6T	160 ug/L	7 ug/L	Round 13/6 Oct 99
Bedrock Aquifer				
Trichloroethene	RAP1-6R	1,200 ug/L	5 ug/L	Round 13/6 Oct 99
Cis-1,2-Dichloroethene	RAP1-6R	4,100 ug/L	70 ug/L	Round 13/6 Oct 99
Vinyl Chloride	RAP1-6R	700 ug/L	2 ug/L	Round 13/6 Oct 99
1,1Dichloroethane	RAP1-6R	220 ug/L	70 ug/L	Round 13/6 Oct 99
1,1Dichloroethene	RAP1-6R	120 ug/	7 ug/L	Round 13/6 Oct 99
Site 2 Plume Source Area				
Surface Aquifer				
Trichloroethene	OW 2-7	130 ug/L	5 ug/L	Round 11/18 May 98
Cis-1,2-Dichloroethene	OW 2-8	70 ug/L	70 ug/L	Round 11/18 May 98
Lower Aquifer				
Trichloroethene	B-115	270 ug/L	5 ug/L	Round 13/6 Oct 99
Cis-1,2-Dichloroethene	B-115	190 ug/L	70 ug/L	Round 13/6 Oct 99
Vinyl Chloride	B-115	16 ug/L	2 ug/L	Round 13/6 Oct 99
Bedrock Aquifer None Detected				Round 13/ Oct-Dec 99
Site 2 Plume				
Surface Aquifer None Detected				Round 13/ Oct-Dec 99
Lower Aquifer				
Trichloroethene	B108	14 ug/L	5.0 ug/L	Round 13/6 Oct 99
Bedrock Aquifer None Detected				Round 13/ Oct-Dec 99
Site 3 Plume Source				
Surface Aquifer				
Cis-1,2-Dichloroethene	B118	100 ug/L	70 ug/L	Round 13/10 Nov 99
Lower Aquifer None Detected				Round 13/Oct-Dec 99
Bedrock Aquifer None Detected				Round 13/Oct-Dec 99
Site 3 Plume				
Surface Aquifer				
Trichloroethene	RAP3-3S	270 ug/L	5.0 ug/L	Round 13/10 Nov 99
Lower Aquifer None Detected				Round 13/Oct-Dec 99
Bedrock Aquifer None Detected				Round 13/ Oct-Dec 99
Site 1 & 2 Off-site Plume				
Surface Aquifer None Detected				
Lower Aquifer				Round 13/15 Nov 99
Trichloroethene				
Cis-1,2-Dichloroethene	B248	690 ug/L	5 ug/L	Round 13/15 Nov 99
Bedrock Aquifer	B248	230 ug/L	70 ug/L	Round 13/15 Nov 99
Trichloroethene	B249	13 ug/L	5 ug/L	Round 13/ 15 Nov 99

contaminant plume position predictions based on the remedial scenarios considered. These models enable project managers and scientists to predict the location of remaining groundwater contaminants under each cleanup scenario.

The groundwater flow model used three layers to represent flow in the shallow bedrock and overlying unconsolidated sediments at and around Hanscom Field. The simulated water table for all three layers indicated a general pattern of flow from the hills toward the lowlands, with discharge to Elm Brook, the Shawsheen River headwaters, and an un-named drainage channel in the Bedford Town Forest. In addition, to the groundwater flow model data, groundwater contour lines have been determined (based on groundwater elevation measurements collected during LTSP Round 11) and are presented in Figures 2-4 through 2-7 for the three aquifers (unconfined, lower, and bedrock). Both the groundwater model and the field data indicate groundwater flow is generally toward the northeast for all three aquifers. Therefore, the greatest likelihood of offsite migration is to the northeast towards the Bedford Town Forest. The groundwater model indicated that in the lowland areas vertical flow is generally upwards from the bedrock aquifer to the lower aquifer, but the vertical gradients are quite small.

Using groundwater contaminant concentration data from LTSP Round 11 1998, the approximate extent of total VOCs in groundwater for the unconfined, lower, and bedrock aquifers at Sites 1, 2 and 3 was determined and is presented in Figures 2-8 through 2-11. For a more detailed description of the groundwater flow characteristics observed at the site, as well as a description of the nature and extent of OU-1 groundwater contamination, please refer to the H&A Field Investigation Report – Sampling Round No. 11 (H&A, 1998).

In order to assess the potential for continued degradation of groundwater quality from infiltration through soils within the OU-1 area, a soil to groundwater pathway analysis was conducted. The results of the soil to groundwater modeling indicate that it is unlikely that residual levels of VOCs in soils at the plume source areas (Sites 1, 2, and 3) are contributing significantly to the groundwater contamination identified in each of these areas. For a detailed presentation of the soil to groundwater pathway analysis see Section 2.7.1.1, Potential Risks from Soil Contamination, of this IROD.

2.5.2.2 Soils

As noted above, extensive response actions were undertaken by the U.S. Air Force at OU-1 Sites 1, 2, and 3 in the late 1980s. These actions were intended to remove buried containers and/or visually contaminated soils at these three areas. Also, as discussed in Section 2.2.2, Hanscom AFB partnered with EPA and Tufts University on a soil sampling program in 1996. COCs detected during the 1996 investigation above MCP S-1, GW-1 standards included trichloroethene (0.03 – 2,100 mg/Kg), cis-1,2-dichloroethene (0.005 – 160 mg/kg), 1,2 – dichloroethane (0.03 – 0.12 mg/Kg), tetrachloroethene (0.02 – 0.54), and toluene (0.02 – 280 mg/Kg). The data from this 1996 soil sampling program was also used by CH2M HILL to evaluate the soil-to-groundwater contaminant transport pathway at confirmed OU-1 plume source areas. See section 2.7.1.1, Potential Risks from Soil Contamination, below for the results of this evaluation.

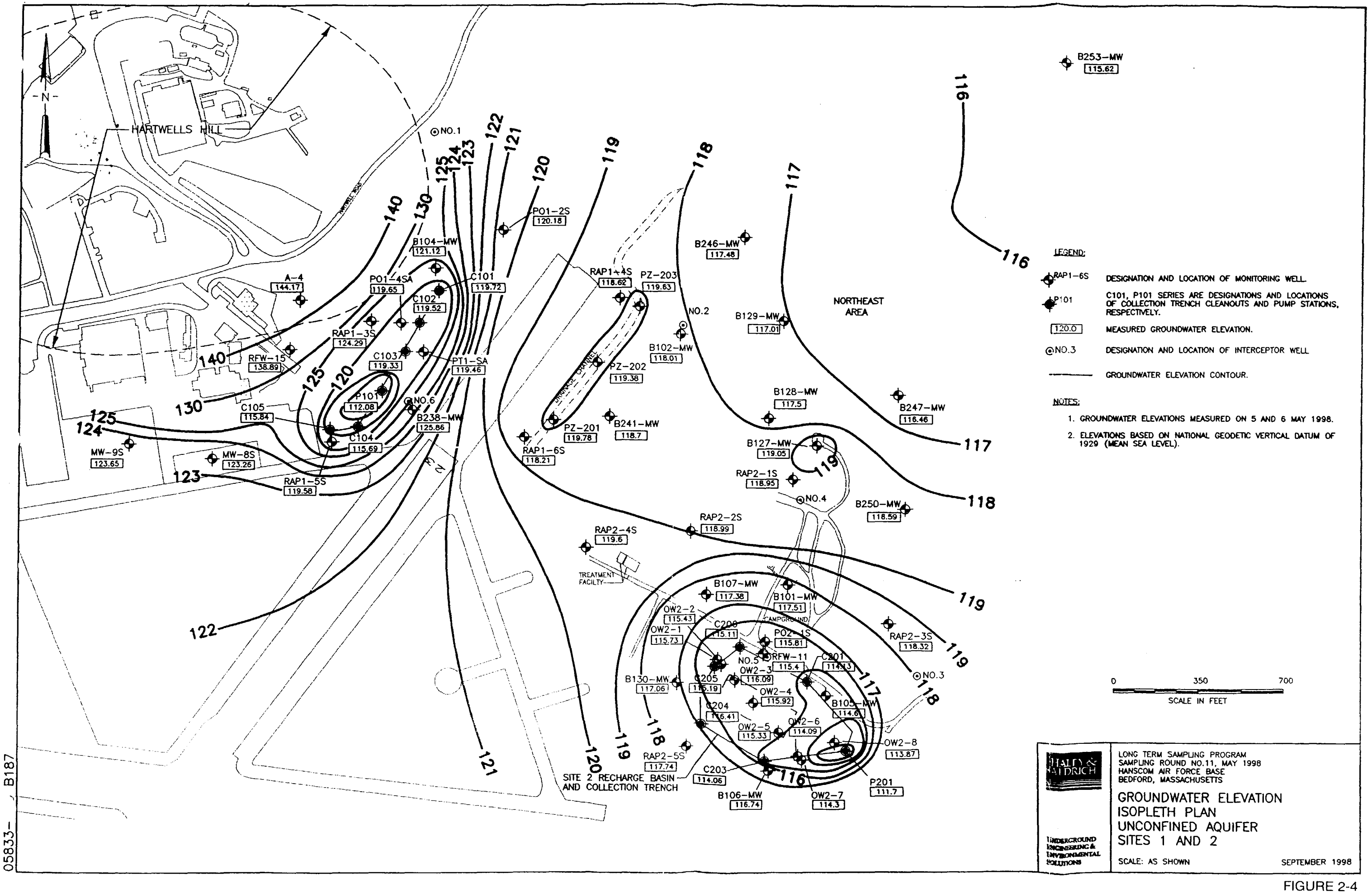

N
HARTWELLS HILL
MITCHELL ROAD
NO.1
NO.2
NO.3
NO.4
NO.5
NO.6
NORTHEAST AREA
DRAINAGE CHANNEL
TREATMENT FACILTY
CAMPGROUND
SITE 2 RECHARGE BASIN AND COLLECTION TRENCH
B253-MW 115.62
B246-MW 117.48
B129-MW 117.01
B102-MW 118.01
B128-MW 117.5
B247-MW 116.46
B127-MW 119.05
B250-MW 118.59
B104-MW 121.12
PO1-2S 120.18
PO1-4SA 119.65
A-4 144.17
C101 119.72
C102 119.52
RAP1-4S 118.62
PZ-203 119.63
RAP1-3S 124.29
RFW-15 138.89
C103 119.33
PT1-SA 119.46
PZ-202 119.38
P101 112.08
C105 115.84
B238-MW 125.86
C104 115.69
PZ-201 119.78
B241-MW 118.7
RAP1-6S 118.21
MW-9S 123.65
MW-8S 123.26
RAP1-5S 119.58
RAP2-1S 118.95
RAP2-2S 118.99
RAP2-4S 119.6
B107-MW 117.38
B101-MW 117.51
OW2-2 115.43
OW2-1 115.73
C206 115.11
PO2-1S 115.81
RFW-11 115.4
C201 114.13
RAP2-3S 118.32
OW2-3 116.09
B130-MW 117.06
C205 115.19
OW2-4 115.92
B105-MW 114.6
C204 116.41
OW2-5 115.33
OW2-6 114.09
OW2-8 113.87
RAP2-5S 117.74
C203 114.06
P201 111.7
B106-MW 116.74
OW2-7 114.3
116
117
118
119
120
121
122
123
124
125
130
140
LEGEND:
RAP1-6S DESIGNATION AND LOCATION OF MONITORING WELL.
P101 C101, P101 SERIES ARE DESIGNATIONS AND LOCATIONS OF COLLECTION TRENCH CLEANOUTS AND PUMP STATIONS, RESPECTIVELY.
120.0 MEASURED GROUNDWATER ELEVATION.
NO.3 DESIGNATION AND LOCATION OF INTERCEPTOR WELL
GROUNDWATER ELEVATION CONTOUR.
NOTES:
1. GROUNDWATER ELEVATIONS MEASURED ON 5 AND 6 MAY 1998.
2. ELEVATIONS BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929 (MEAN SEA LEVEL).
0
350
700
SCALE IN FEET
HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS
LONG TERM SAMPLING PROGRAM
SAMPLING ROUND NO.11, MAY 1998
HANSCOM AIR FORCE BASE
BEDFORD, MASSACHUSETTS
GROUNDWATER ELEVATION
ISOPLETH PLAN
UNCONFINED AQUIFER
SITES 1 AND 2
SCALE: AS SHOWN
SEPTEMBER 1998
05833-, B187

FIGURE 2-4

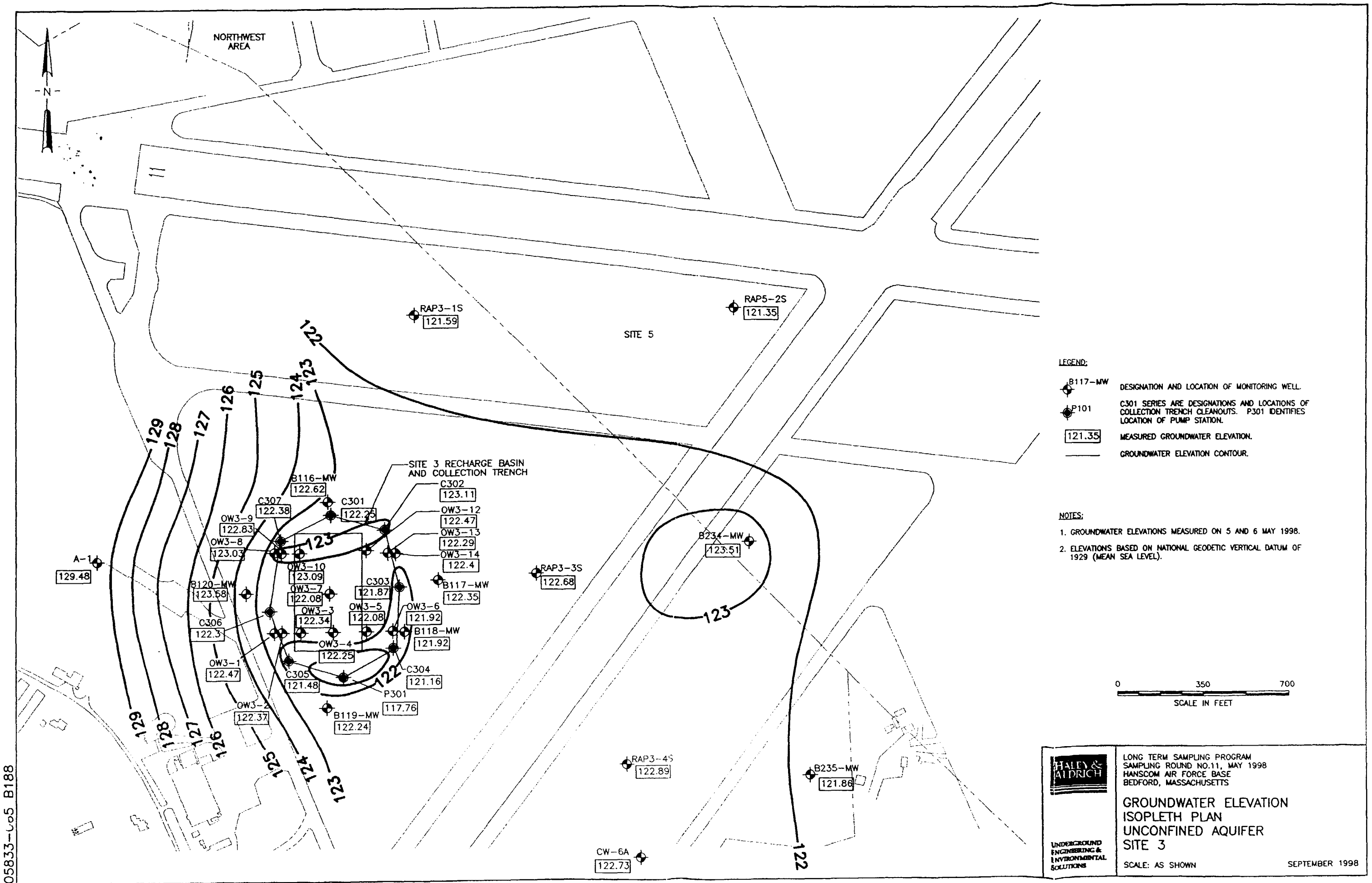
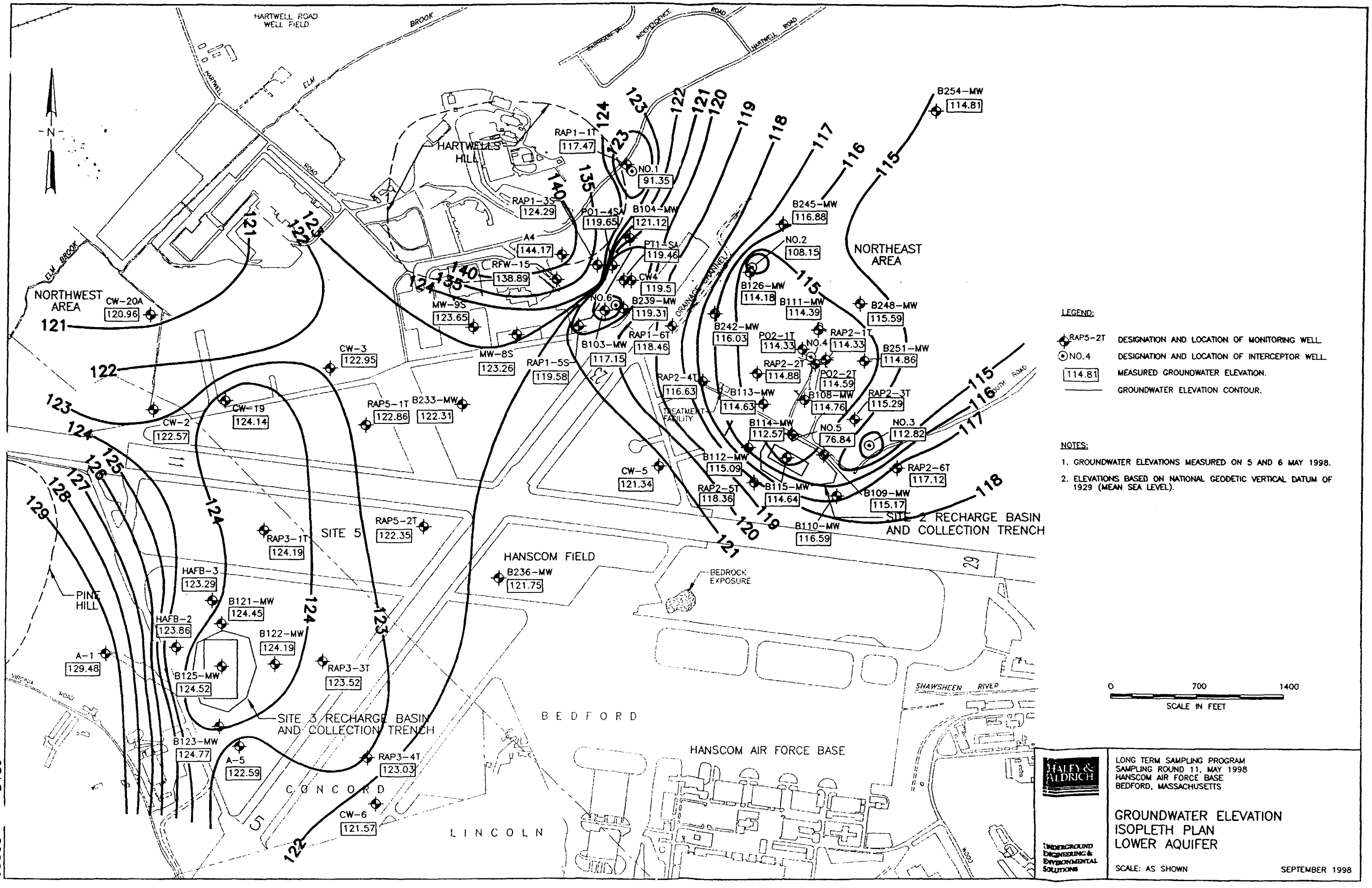

NORTHWEST AREA
-N-
11
SITE 5
RAP3-1S
121.59
RAP5-2S
121.35
SITE 3 RECHARGE BASIN AND COLLECTION TRENCH
B116-MW
122.62
C307
122.38
C301
122.25
C302
123.11
OW3-12
122.47
OW3-13
122.29
OW3-14
122.4
OW3-9
122.83
OW3-8
123.03
OW3-10
123.09
OW3-7
122.08
OW3-3
122.34
OW3-5
122.08
OW3-6
121.92
OW3-4
122.25
OW3-1
122.47
OW3-2
122.37
A-1
129.48
B120-MW
123.58
C306
122.3
C303
121.87
B117-MW
122.35
B118-MW
121.92
C304
121.16
C305
121.48
P301
117.76
B119-MW
122.24
RAP3-3S
122.68
B234-MW
123.51
RAP3-4S
122.89
B235-MW
121.86
CW-6A
122.73
129
128
127
126
125
124
123
122
LEGEND:
B117-MW
DESIGNATION AND LOCATION OF MONITORING WELL.
P101
C301 SERIES ARE DESIGNATIONS AND LOCATIONS OF COLLECTION TRENCH CLEANOUTS. P301 IDENTIFIES LOCATION OF PUMP STATION.
121.35
MEASURED GROUNDWATER ELEVATION.
GROUNDWATER ELEVATION CONTOUR.
NOTES:
1. GROUNDWATER ELEVATIONS MEASURED ON 5 AND 6 MAY 1998.
2. ELEVATIONS BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929 (MEAN SEA LEVEL).
0
350
700
SCALE IN FEET
HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS
LONG TERM SAMPLING PROGRAM
SAMPLING ROUND NO.11, MAY 1998
HANSCOM AIR FORCE BASE
BEDFORD, MASSACHUSETTS
GROUNDWATER ELEVATION
ISOPLETH PLAN
UNCONFINED AQUIFER
SITE 3
SCALE: AS SHOWN
SEPTEMBER 1998
05833-005 B188

FIGURE 2-5



LEGEND:

- RAP5-2T — DESIGNATION AND LOCATION OF MONITORING WELL
- NO.4 — DESIGNATION AND LOCATION OF INTERCEPTOR WELL
- 114.81 — MEASURED GROUNOWATER ELEVATION.
- ——— GROUNDWATER ELEVATION CONTOUR.

NOTES:

1. GROUNDWATER ELEVATIONS MEASURED ON 5 AND 6 MAY 1998.
2. ELEVATIONS BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929 (MEAN SEA LEVEL).

HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

LONG TERM SAMPLING PROGRAM
SAMPLING ROUND 11, MAY 1998
HANSCOM AIR FORCE BASE
BEDFORD, MASSACHUSETTS

GROUNDWATER ELEVATION ISOPLETH PLAN LOWER AQUIFER

SCALE: AS SHOWN

SEPTEMBER 1998

FIGURE 2-6

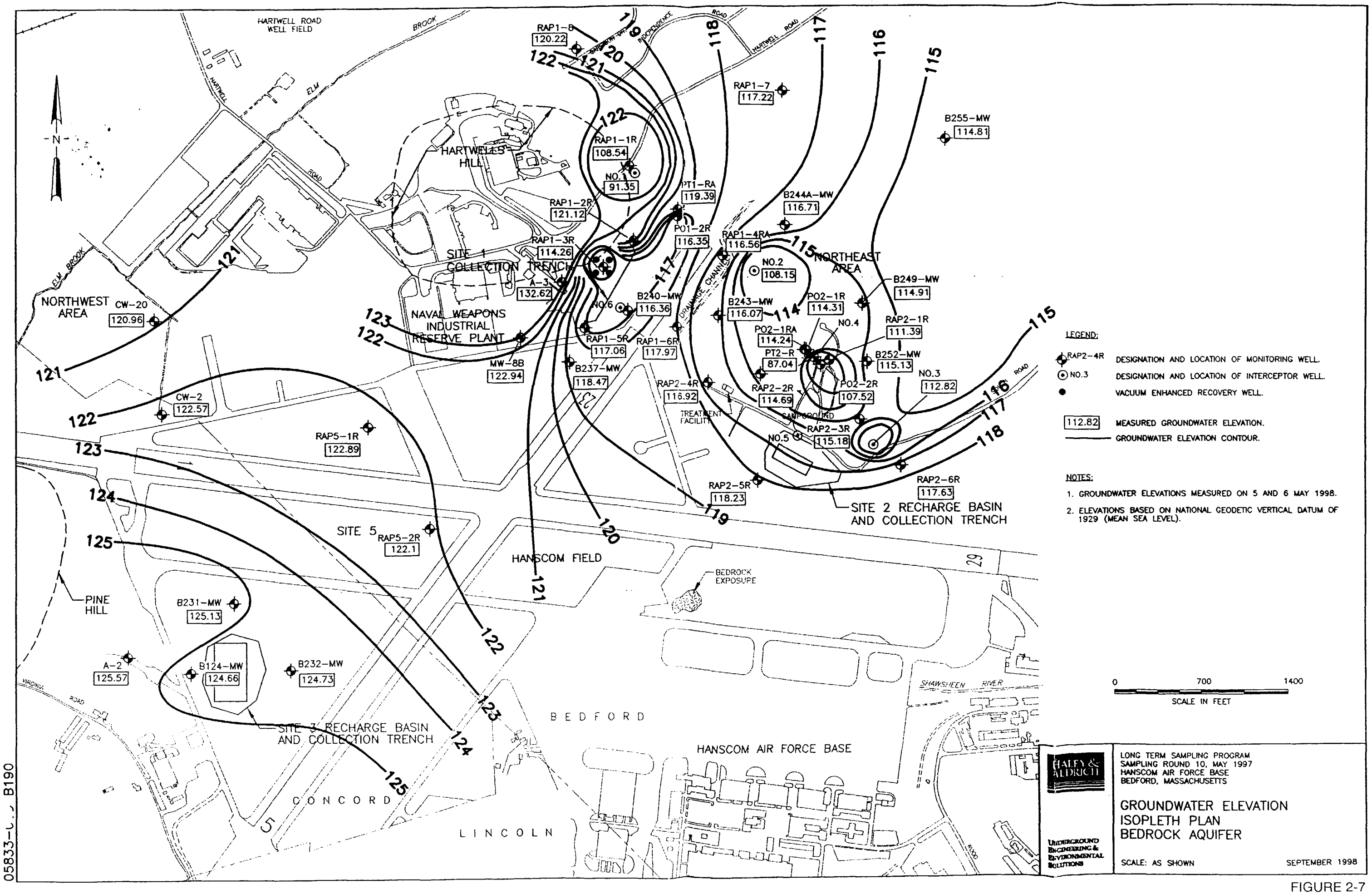
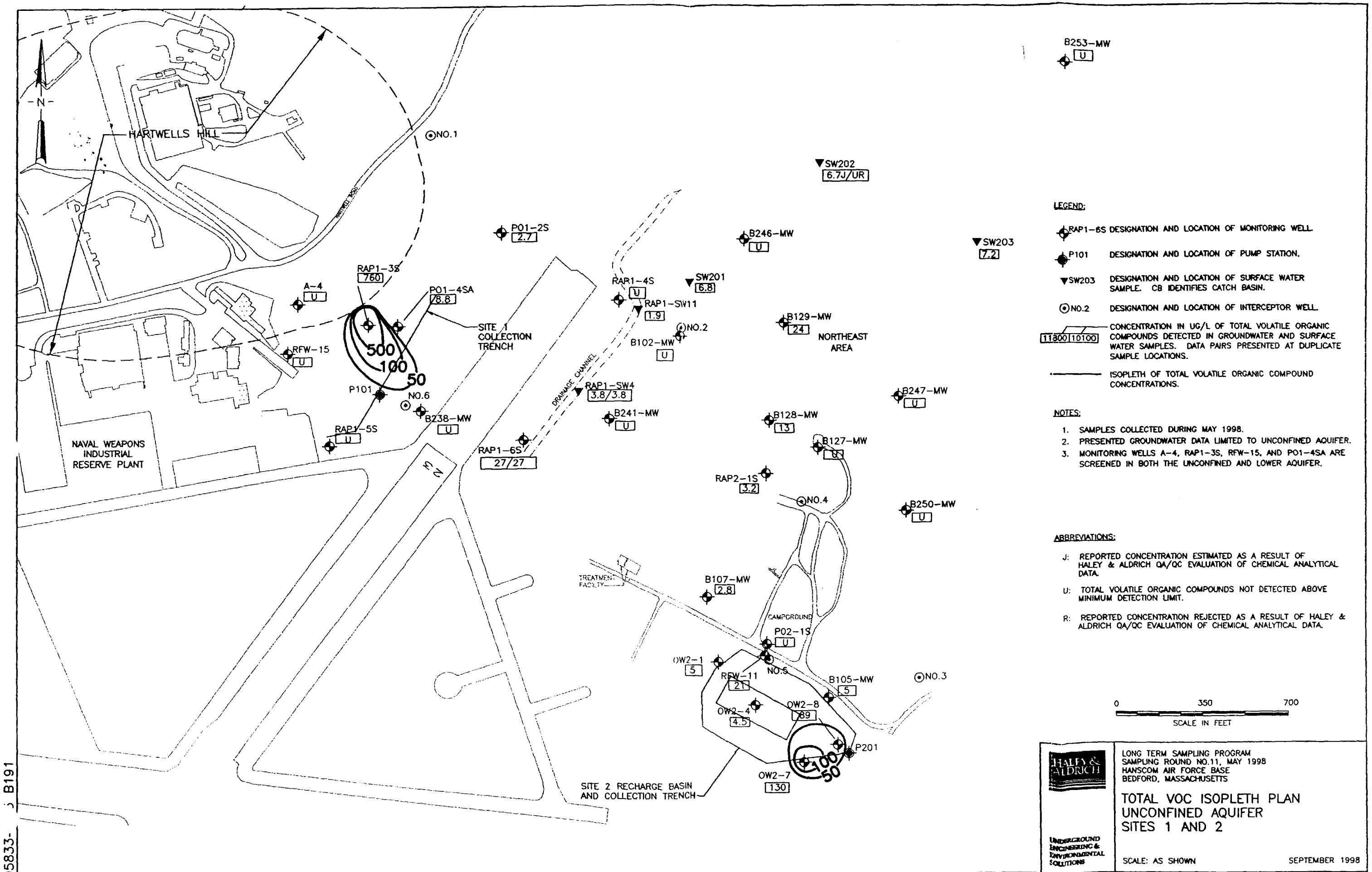

HARTWELL ROAD WELL FIELD
BROOK
ELM
HARTWELL
ROAD
N
HARTWELL'S HILL
SITE 1 COLLECTION TRENCH
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
NORTHWEST AREA
ELM BROOK
NORTHEAST AREA
OPPENHEIM CHANNEL
INDEPENDENCE ROAD
HARTWELL ROAD
TREATMENT FACILITY
CAMPGROUND
SITE 2 RECHARGE BASIN AND COLLECTION TRENCH
SITE 5
HANSCOM FIELD
BEDROCK EXPOSURE
PINE HILL
VIRGINIA ROAD
SITE 3 RECHARGE BASIN AND COLLECTION TRENCH
SHAWSHEEN RIVER
BEDFORD
HANSCOM AIR FORCE BASE
CONCORD
LINCOLN
RAP1-8 120.22
RAP1-7 117.22
RAP1-1R 108.54
NO.1 91.35
RAP1-2R 121.12
PT1-RA 119.39
PO1-2R 116.35
RAP1-3R 114.26
A-3 132.62
NO.6
B240-MW 116.36
RAP1-5R 117.06
RAP1-6R 117.97
B237-MW 118.47
MW-8B 122.94
RAP1-4RA 116.56
NO.2 108.15
B244A-MW 116.71
B255-MW 114.81
B249-MW 114.91
B243-MW 116.07
PO2-1R 114.31
PO2-1RA 114.24
PT2-R 87.04
NO.4
RAP2-1R 111.39
B252-MW 115.13
NO.3 112.82
RAP2-2R 114.69
PO2-2R 107.52
RAP2-4R 116.92
RAP2-3R 115.18
NO.5
RAP2-5R 118.23
RAP2-6R 117.63
CW-20 120.96
CW-2 122.57
RAP5-1R 122.89
RAP5-2R 122.1
B231-MW 125.13
A-2 125.57
B124-MW 124.66
B232-MW 124.73
118
117
116
115
114
123
122
121
120
119
124
125
29
5
495
LEGEND:
RAP2-4R DESIGNATION AND LOCATION OF MONITORING WELL.
NO.3 DESIGNATION AND LOCATION OF INTERCEPTOR WELL.
VACUUM ENHANCED RECOVERY WELL.
112.82 MEASURED GROUNDWATER ELEVATION.
GROUNDWATER ELEVATION CONTOUR.
NOTES:
1. GROUNDWATER ELEVATIONS MEASURED ON 5 AND 6 MAY 1998.
2. ELEVATIONS BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929 (MEAN SEA LEVEL).
0
700
1400
SCALE IN FEET
HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS
LONG TERM SAMPLING PROGRAM
SAMPLING ROUND 10, MAY 1997
HANSCOM AIR FORCE BASE
BEDFORD, MASSACHUSETTS
GROUNDWATER ELEVATION ISOPLETH PLAN BEDROCK AQUIFER
SCALE: AS SHOWN
SEPTEMBER 1998
05833-U , B190

FIGURE 2-7



LEGEND:

- RAP1-6S — DESIGNATION AND LOCATION OF MONITORING WELL.
- P101 — DESIGNATION AND LOCATION OF PUMP STATION.
- SW203 — DESIGNATION AND LOCATION OF SURFACE WATER SAMPLE. CB IDENTIFIES CATCH BASIN.
- NO.2 — DESIGNATION AND LOCATION OF INTERCEPTOR WELL.
- 11800 | 10100 — CONCENTRATION IN UG/L OF TOTAL VOLATILE ORGANIC COMPOUNDS DETECTED IN GROUNDWATER AND SURFACE WATER SAMPLES. DATA PAIRS PRESENTED AT DUPLICATE SAMPLE LOCATIONS.
- ——— ISOPLETH OF TOTAL VOLATILE ORGANIC COMPOUND CONCENTRATIONS.

NOTES:

1. SAMPLES COLLECTED DURING MAY 1998.
2. PRESENTED GROUNDWATER DATA LIMITED TO UNCONFINED AQUIFER.
3. MONITORING WELLS A-4, RAP1-3S, RFW-15, AND PO1-4SA ARE SCREENED IN BOTH THE UNCONFINED AND LOWER AQUIFER.

ABBREVIATIONS:

J: REPORTED CONCENTRATION ESTIMATED AS A RESULT OF HALEY & ALDRICH QA/QC EVALUATION OF CHEMICAL ANALYTICAL DATA.

U: TOTAL VOLATILE ORGANIC COMPOUNDS NOT DETECTED ABOVE MINIMUM DETECTION LIMIT.

R: REPORTED CONCENTRATION REJECTED AS A RESULT OF HALEY & ALDRICH QA/QC EVALUATION OF CHEMICAL ANALYTICAL DATA.

0 350 700
SCALE IN FEET

HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

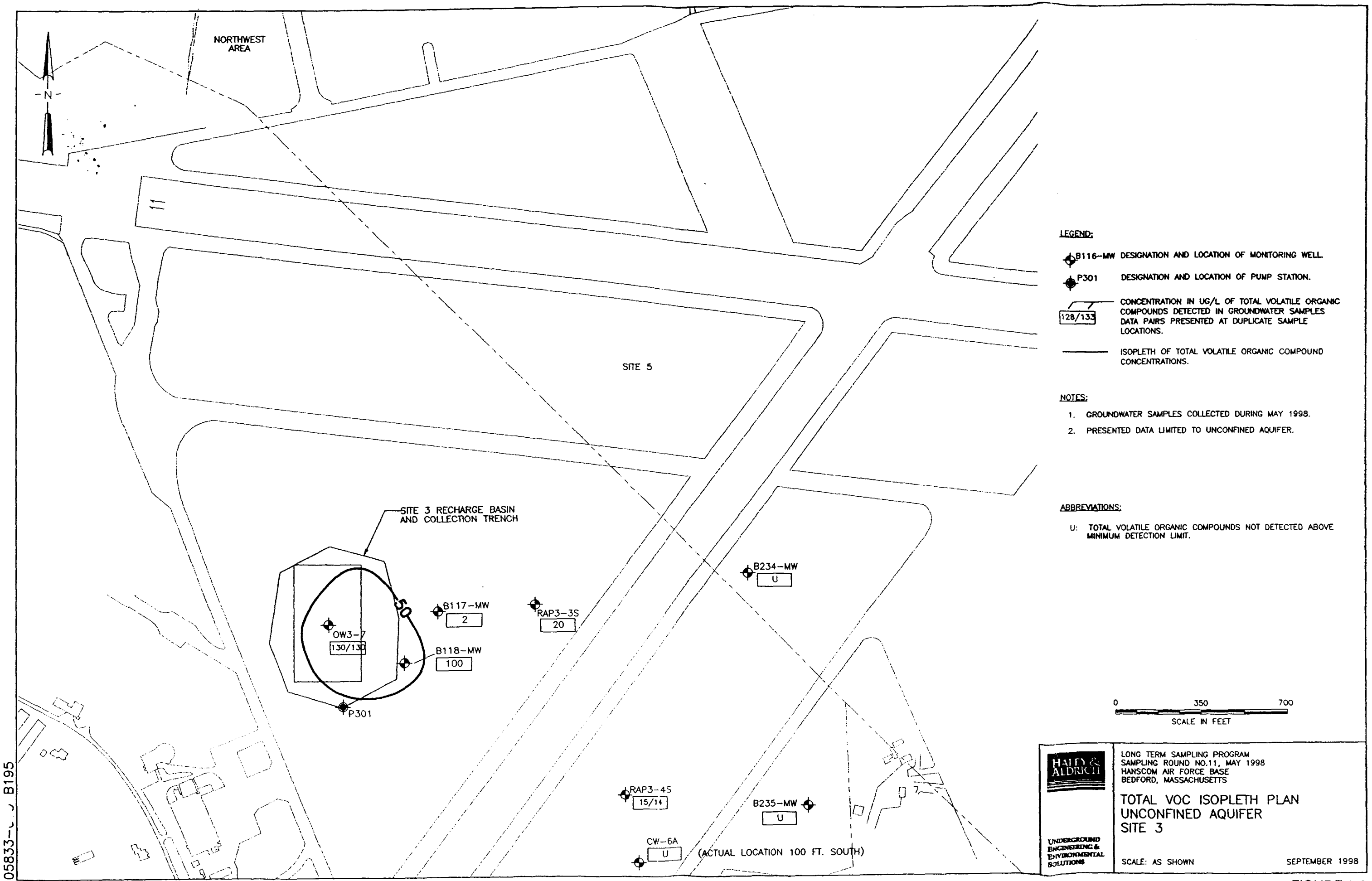
LONG TERM SAMPLING PROGRAM
SAMPLING ROUND NO.11, MAY 1998
HANSCOM AIR FORCE BASE
BEDFORD, MASSACHUSETTS

TOTAL VOC ISOPLETH PLAN UNCONFINED AQUIFER SITES 1 AND 2

SCALE: AS SHOWN — SEPTEMBER 1998

05833-

FIGURE 2-8



LEGEND:

- B116-MW — DESIGNATION AND LOCATION OF MONITORING WELL.
- P301 — DESIGNATION AND LOCATION OF PUMP STATION.
- 128/133 — CONCENTRATION IN UG/L OF TOTAL VOLATILE ORGANIC COMPOUNDS DETECTED IN GROUNDWATER SAMPLES DATA PAIRS PRESENTED AT DUPLICATE SAMPLE LOCATIONS.
- ——— ISOPLETH OF TOTAL VOLATILE ORGANIC COMPOUND CONCENTRATIONS.

NOTES:

1. GROUNDWATER SAMPLES COLLECTED DURING MAY 1998.
2. PRESENTED DATA LIMITED TO UNCONFINED AQUIFER.

ABBREVIATIONS:

U: TOTAL VOLATILE ORGANIC COMPOUNDS NOT DETECTED ABOVE MINIMUM DETECTION LIMIT.

HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

LONG TERM SAMPLING PROGRAM
SAMPLING ROUND NO.11, MAY 1998
HANSCOM AIR FORCE BASE
BEDFORD, MASSACHUSETTS

TOTAL VOC ISOPLETH PLAN UNCONFINED AQUIFER SITE 3

SCALE: AS SHOWN

SEPTEMBER 1998

05833-[illegible] B195

FIGURE 2-9

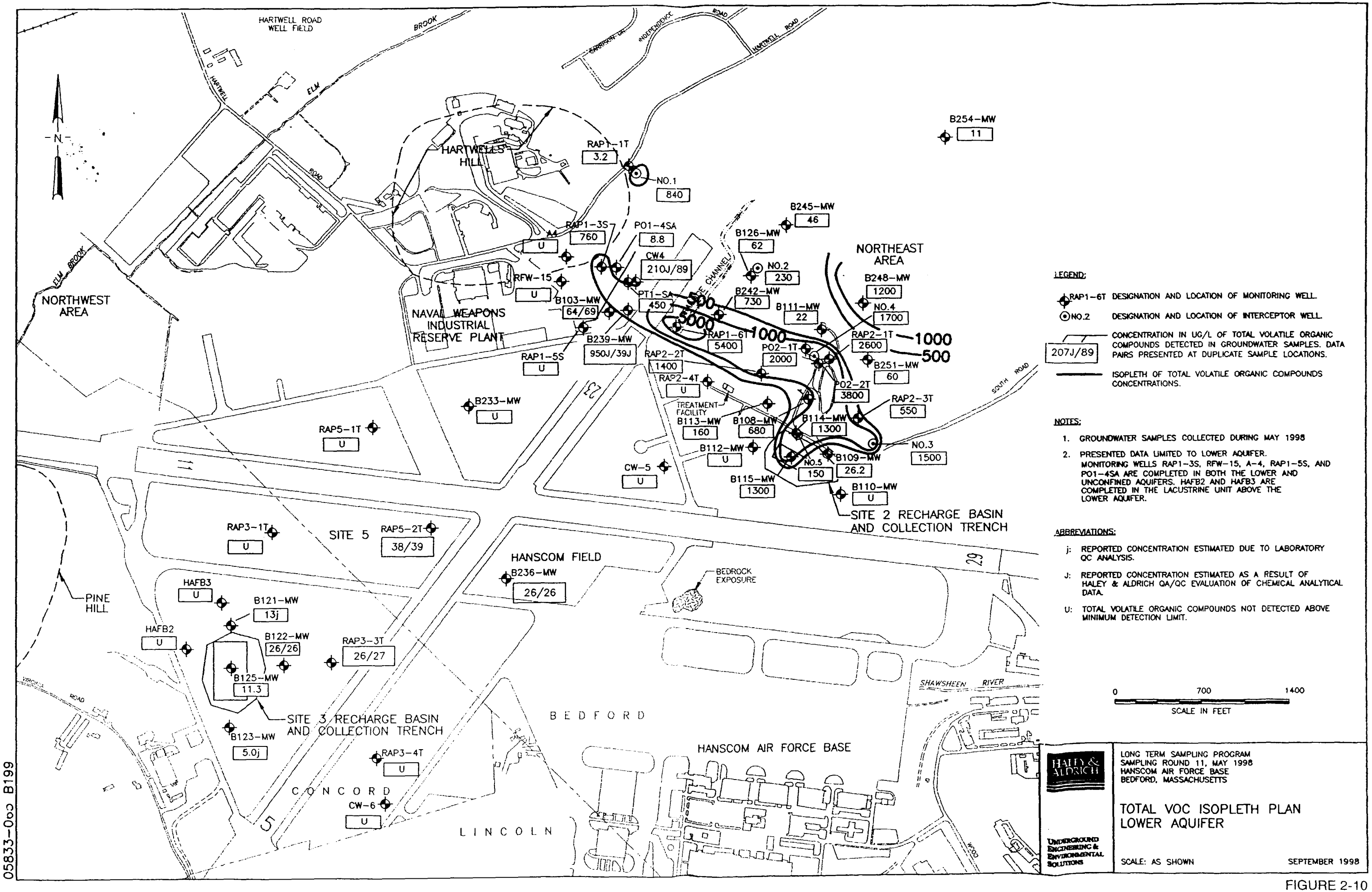
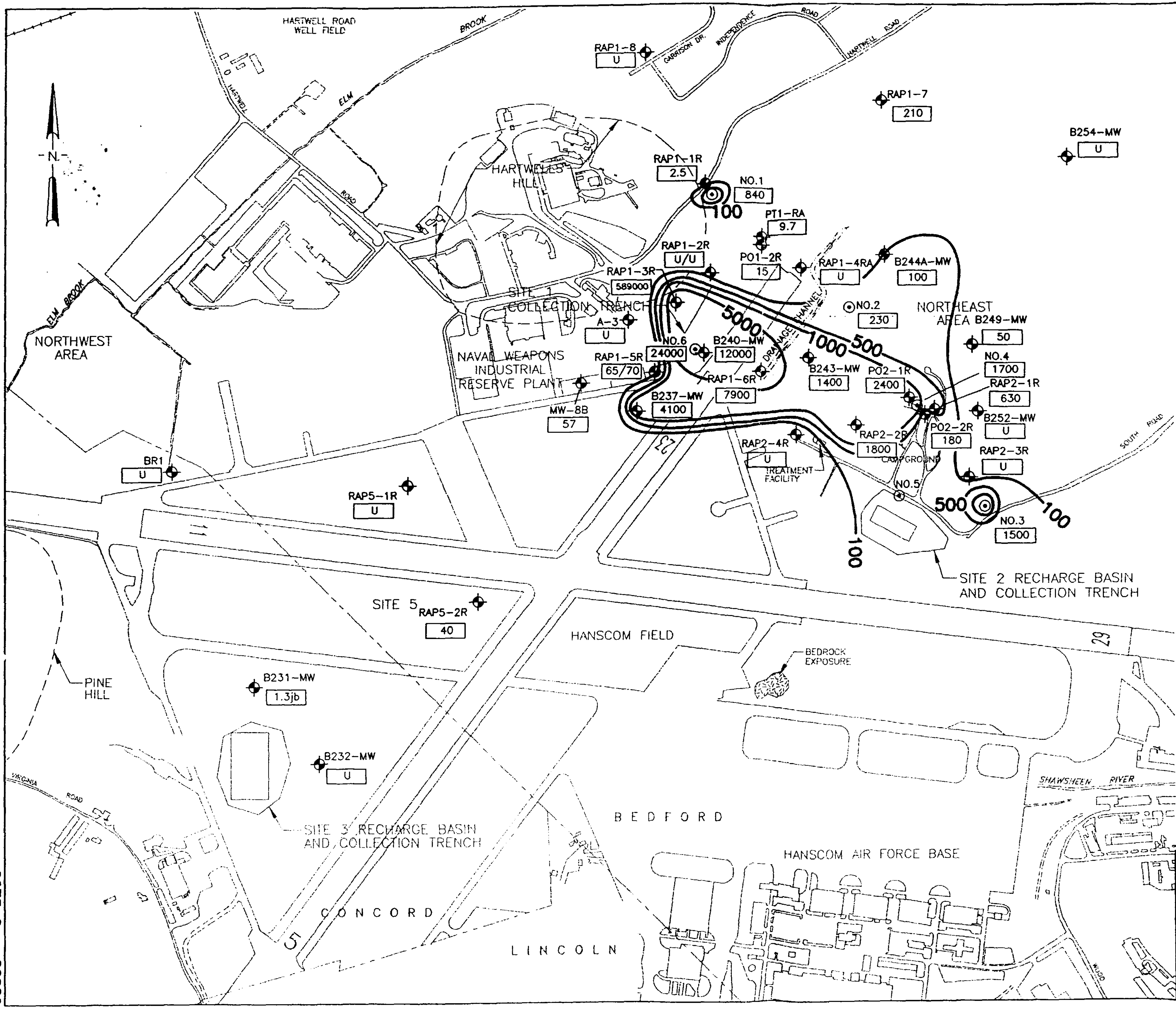

HARTWELL ROAD WELL FIELD
HARTWELL
ELM
BROOK
ROAD
INDEPENDENCE
HARTWELL ROAD
HARRISON DR.
N
HARTWELLS HILL
NORTHWEST AREA
ELM BROOK
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
RAP1-1T 3.2
NO.1 840
RAP1-3S 760
PO1-4SA 8.8
A4 U
CW4 210J/89
RFW-15 U
B103-MW 64/69
PT1-SA 450
B239-MW 950J/39J
RAP1-5S U
RAP1-6T 5400
RAP2-2T 1400
RAP2-4T U
B254-MW 11
B245-MW 46
B126-MW 62
NO.2 230
NORTHEAST AREA
B248-MW 1200
NO.4 1700
B242-MW 730
B111-MW 22
RAP2-1T 2600
PO2-1T 2000
B251-MW 60
PO2-2T 3800
RAP2-3T 550
B114-MW 1300
NO.3 1500
B109-MW 26.2
NO.5 150
B110-MW U
B115-MW 1300
B108-MW 680
B113-MW 160
B112-MW U
TREATMENT FACILITY
CW-5 U
B233-MW U
RAP5-1T U
SITE 2 RECHARGE BASIN AND COLLECTION TRENCH
SOUTH ROAD
RAP3-1T U
SITE 5
RAP5-2T 38/39
HANSCOM FIELD
B236-MW 26/26
BEDROCK EXPOSURE
HAFB3 U
B121-MW 13j
PINE HILL
HAFB2 U
B122-MW 26/26
RAP3-3T 26/27
B125-MW 11.3
SITE 3 RECHARGE BASIN AND COLLECTION TRENCH
B123-MW 5.0j
RAP3-4T U
CW-6 U
VIRGINIA ROAD
BEDFORD
CONCORD
LINCOLN
HANSCOM AIR FORCE BASE
SHAWSHEEN RIVER
WOOD
29
5
500
1000
5000
1000
500
LEGEND:
RAP1-6T DESIGNATION AND LOCATION OF MONITORING WELL.
NO.2 DESIGNATION AND LOCATION OF INTERCEPTOR WELL.
207J/89 CONCENTRATION IN UG/L OF TOTAL VOLATILE ORGANIC COMPOUNDS DETECTED IN GROUNDWATER SAMPLES. DATA PAIRS PRESENTED AT DUPLICATE SAMPLE LOCATIONS.
ISOPLETH OF TOTAL VOLATILE ORGANIC COMPOUNDS CONCENTRATIONS.
NOTES:
1. GROUNDWATER SAMPLES COLLECTED DURING MAY 1998
2. PRESENTED DATA LIMITED TO LOWER AQUIFER. MONITORING WELLS RAP1-3S, RFW-15, A-4, RAP1-5S, AND PO1-4SA ARE COMPLETED IN BOTH THE LOWER AND UNCONFINED AQUIFERS. HAFB2 AND HAFB3 ARE COMPLETED IN THE LACUSTRINE UNIT ABOVE THE LOWER AQUIFER.
ABBREVIATIONS:
j: REPORTED CONCENTRATION ESTIMATED DUE TO LABORATORY QC ANALYSIS.
J: REPORTED CONCENTRATION ESTIMATED AS A RESULT OF HALEY & ALDRICH QA/QC EVALUATION OF CHEMICAL ANALYTICAL DATA.
U: TOTAL VOLATILE ORGANIC COMPOUNDS NOT DETECTED ABOVE MINIMUM DETECTION LIMIT.
0 700 1400
SCALE IN FEET
HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS
LONG TERM SAMPLING PROGRAM
SAMPLING ROUND 11, MAY 1998
HANSCOM AIR FORCE BASE
BEDFORD, MASSACHUSETTS
TOTAL VOC ISOPLETH PLAN
LOWER AQUIFER
SCALE: AS SHOWN
SEPTEMBER 1998
05833-003 B199

FIGURE 2-10



LEGEND:

- RAP1-6S DESIGNATION AND LOCATION OF MONITORING WELL.
- NO.2 DESIGNATION AND LOCATION OF INTERCEPTOR WELL.
- 65/70 CONCENTRATION IN UG/L OF TOTAL VOLATILE ORGANIC COMPOUNDS DETECTED IN GROUNDWATER SAMPLES. DATA PAIRS PRESENTED AT DUPLICATE SAMPLE LOCATIONS.
- ISOPLETH OF TOTAL VOLATILE ORGANIC COMPOUND CONCENTRATIONS.

NOTES:

1. GROUNDWATER SAMPLES COLLECTED DURING MAY 1998.
2. PRESENTED DATA LIMITED TO BEDROCK AQUIFER.

ABBREVIATIONS:

U: TOTAL VOLATILE ORGANIC COMPOUNDS NOT DETECTED ABOVE MINIMUM DETECTION LIMIT.

j: REPORTED CONCENTRATION ESTIMATED ESTIMATED DUE TO LABORATORY QC ANALYSIS.

b: REPORTED CONCENTRATON DETECTED IN LABORATORY BLANK.

0 700 1400
SCALE IN FEET

HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

LONG TERM SAMPLING PROGRAM
SAMPLING ROUND 11, MAY 1998
HANSCOM AIR FORCE BASE
BEDFORD, MASSACHUSETTS

TOTAL VOC ISOPLETH PLAN
BEDROCK AQUIFER

SCALE: AS SHOWN | SEPTEMBER 1998

FIGURE 2-11

05833- ɔ B203

2.5.2.3 Surface Water

The surface water in the drainage channel east of Runway 5-23, which discharges into the Wetland B/beaver pond area north of Hanscom Field, has been analyzed in each of the LTSP rounds. Figure 2-12 presents the location of the drainage channel, wetland area, and beaver pond. Levels of VOCs, which were significantly greater than drinking water standards prior to the commencement of remedial actions, have declined significantly since remedial efforts began. Since 1996 the total VOC concentrations in this drainage channel have been below these standards. Also, in Round 9 in 1996, surface water sampling was expanded to include selected trace metals (cadmium, copper, lead, and zinc). In general, recent surface water sampling has shown the presence of some low concentrations of VOCs and metals. Refer to Section 2.7, Summary of Site Risks, below for risk characterization information.

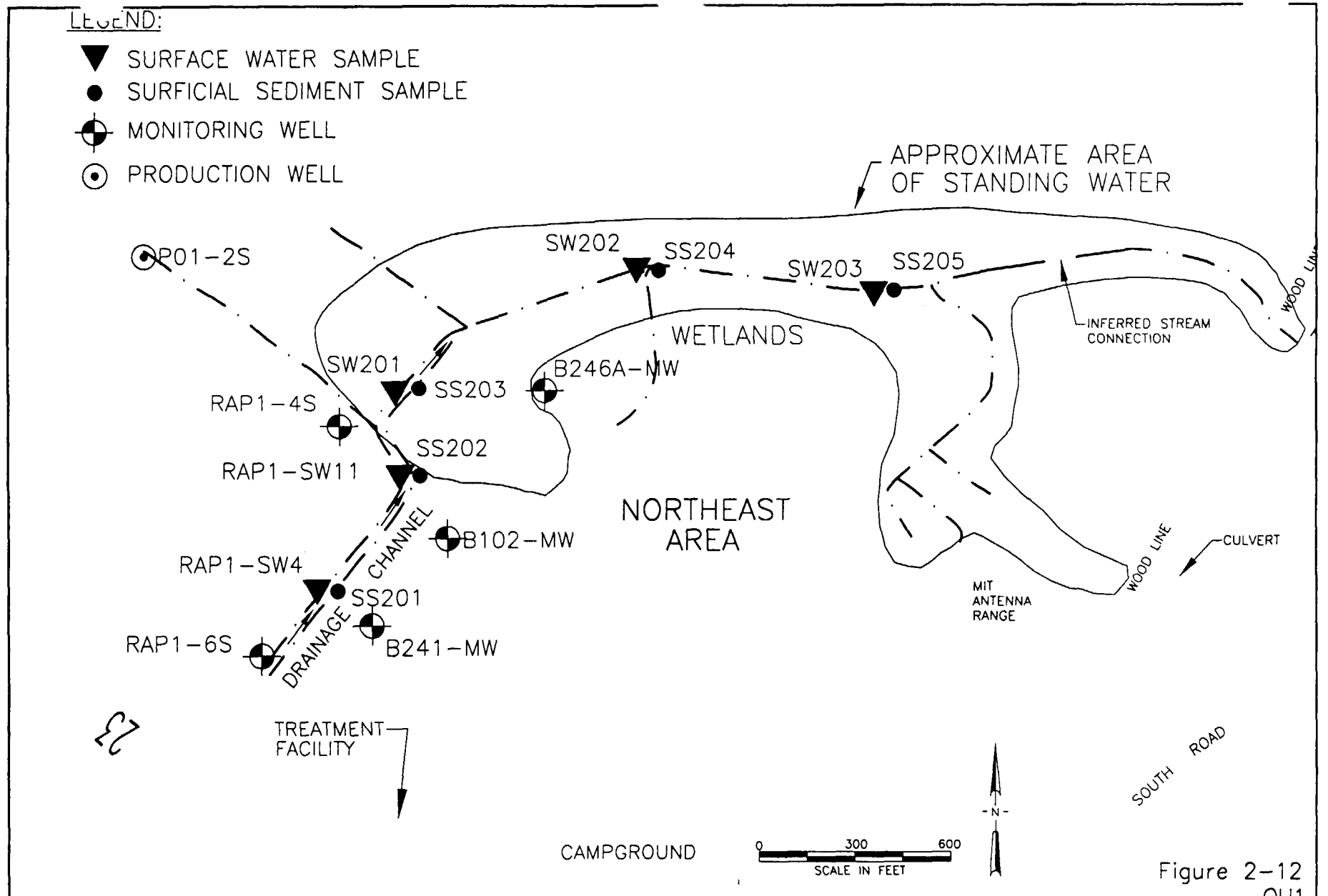
Round 9, 11, and 13 sampling, performed in 1996, 1998, and 1999 respectively, included analysis of surface water within the OU-1 wetland area. Table 2-2 presents COCs detected in surface water above MCLs during LTSP Round 13 in 1999. During Rounds 9 and 11 surface water samples were collected from the drainage trench (sampling points RAP1-SW4 and RAP1-SW11) and wetlands area (sampling points SW201, SW202, and SW203) hydraulically downgradient of Site 1. During Round 13, as part of the planned additional sampling to address the uncertainty that was raised in Ecological Risk Assessment, surface water samples were collected from the drainage trench (sampling point RAP1-SW4) and wetlands area (sampling points SW202, and SW203). The second round of this additional ecological risk sampling is planned as part of the 2000 LTSP.

2.5.2.4 Drainage Channel and Wetland Sediments

LTSP Round 9 sampling in 1996 included analysis of sediments within the drainage channel east of Runway 5-23 and the Wetland B/beaver pond area north of Hanscom Field. A total of five sediment samples were collected for VOC analysis, selected metals (cadmium, copper, lead and zinc), and total organic carbon. The results of the Round 9 sediment sampling, as well as the Round 9 and 11 surface water sampling; were used to evaluate ecological risks in the OU-1 Wetland B/beaver pond area. Sediment analyses indicated the presence of some VOCs in addition to copper, lead, and zinc. During LTSP Round 13, as part of the planned additional sampling to address the uncertainty that was raised in the Ecological Risk Assessment, additional sediment samples were collected from the drainage ditch (RAP1-SW4) and the Wetland/beaver pond area (SW202, and SW203). These samples were analyzed for lead and copper. Lead was detected at concentrations ranging from 17.4 to 53.2 mg/kg, and copper was detected at concentrations ranging from 10.6 to 28.5 mg/kg. Refer to Section 2.7, Summary of Site Risks, below for characterization of risk information. The second round of this additional ecological risk sampling is planned as part of the 2000 LTSP.

2.5.3 The Conceptual Site Model

The conceptual site model (CSM) is a three-dimensional "picture" of site conditions that illustrates contaminant sources, release mechanisms, exposure pathways/migration routes, and potential human and ecological receptors. The CSM documents current and potential future site conditions and shows what is known about human and environmental exposure



SOURCE:
Haley and Aldrich drawing "Northeast Area Features Location Plan", December 1996.

138808/8808F001.DWG

Figure 2-12
OU1
Hanscom AFB
Wetland/Beaver Pond
Sampling Locations

CH2MHILL

from contaminant release and migration to potential receptors. The risk assessment and response actions for the contaminants at OU-1 are based on the CSM. Figures 2-13 and 2-14 present the CSM for the OU-1 human and ecological risk assessment.

2.5.3.1 Site Overview

OU-1 is an area with groundwater contamination that includes five distinct areas of concern, known as IRP Sites 1, 2, 3, 5, and 20, which are all located on Hanscom Field, a civilian airport owned by the Commonwealth of Massachusetts, for which the Air Force is the PRP. Three of these sites (1, 2 and 3) are confirmed plume source areas with residual soil contamination. In addition to Hanscom Field, OU-1 also includes wetland areas and a beaver pond area to the north/northeast of the airfield which is owned by the Town of Bedford, and a small part of Hanscom AFB which is used as a campground. OU-1 lies on a relatively flat plateau that is bordered by low, rounded hills on the north, west, and the south. The low-lying areas consist of wetlands on the east and northeast of the airfield (Wetland B/beaver pond) and a northeast tending drainage channel. The drainage channel also receives the OU-1 groundwater treatment system discharge.

Wetland B is a mature forested swamp associated with a tributary of the Shawsheen River. Wetland B was delineated and named during the Air Force Comprehensive Ecological Analysis by LEC in 1992-1995 (LEC, 1997). Since the LEC investigations, beaver have dammed the drainage channel resulting in a significant portion of the former wetland becoming inundated. Therefore, the nomenclature of Wetland B/beaver pond has been adopted to represent this mixed habitat.

2.5.3.2 Exposure Pathways

Site soils and groundwater are the current contaminant sources with migration of the contaminants in the soil to the groundwater through infiltration/percolation/leaching, and groundwater flow which is influenced by the groundwater collection and treatment system. Since the surface soil contamination was removed as part of previous remedial activities at the site, there is no ground surface exposure pathway , and no migration through surface run-off. However, there is the potential that historic surface run-off resulted in contaminant migration to sediments in Wetland B and the beaver pond. The high organic content of wetland sediments can bind and hold contamination in place for a considerable amount of time. In addition, since groundwater is expected to discharge into the Wetland B/beaver pond area, there exists a potential for contamination to occur in the sediment and surface water as the groundwater flows into these media.

2.6 Current and Potential Future Site and Resource Uses

The majority of OU-1 consists of Hanscom Field, owned by the Commonwealth of Massachusetts, which is currently used as an active civilian/commercial airport operated by MASSPORT and the FAA. Discussions with MASSPORT Hanscom Field officials and review of recent newspaper articles substantiate that this area will continue to be used for civilian and commercial aviation purposes in the future.

The majority of the remaining area of OU-1 includes undeveloped wetlands, beaver pond and forest areas owned by the Town of Bedford and known as the Jordan Conservation

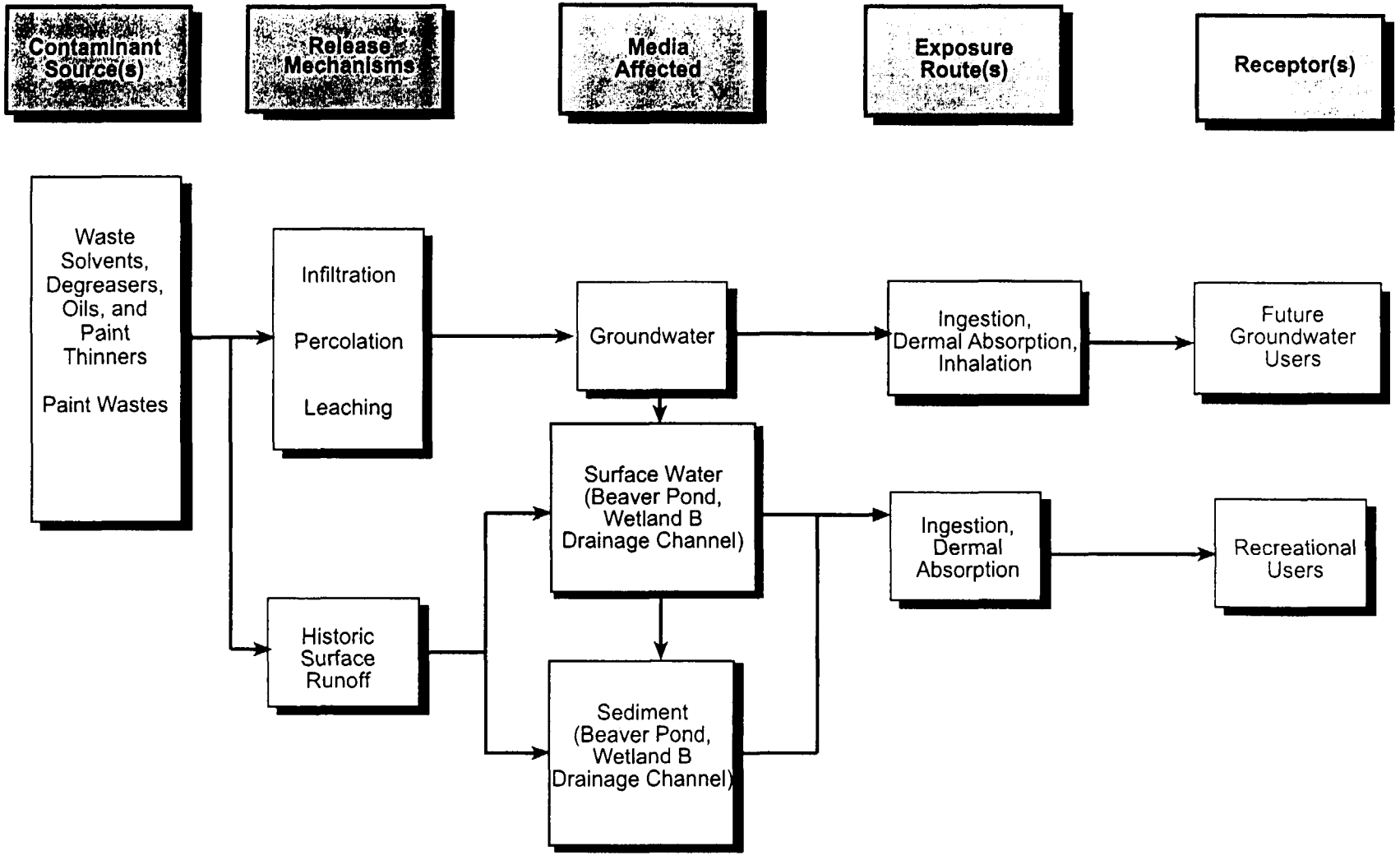


Figure 2-13
Conceptual Site Model
Potential Human Exposure
OU-1, Hanscom AFB, MA

CH2MHILL

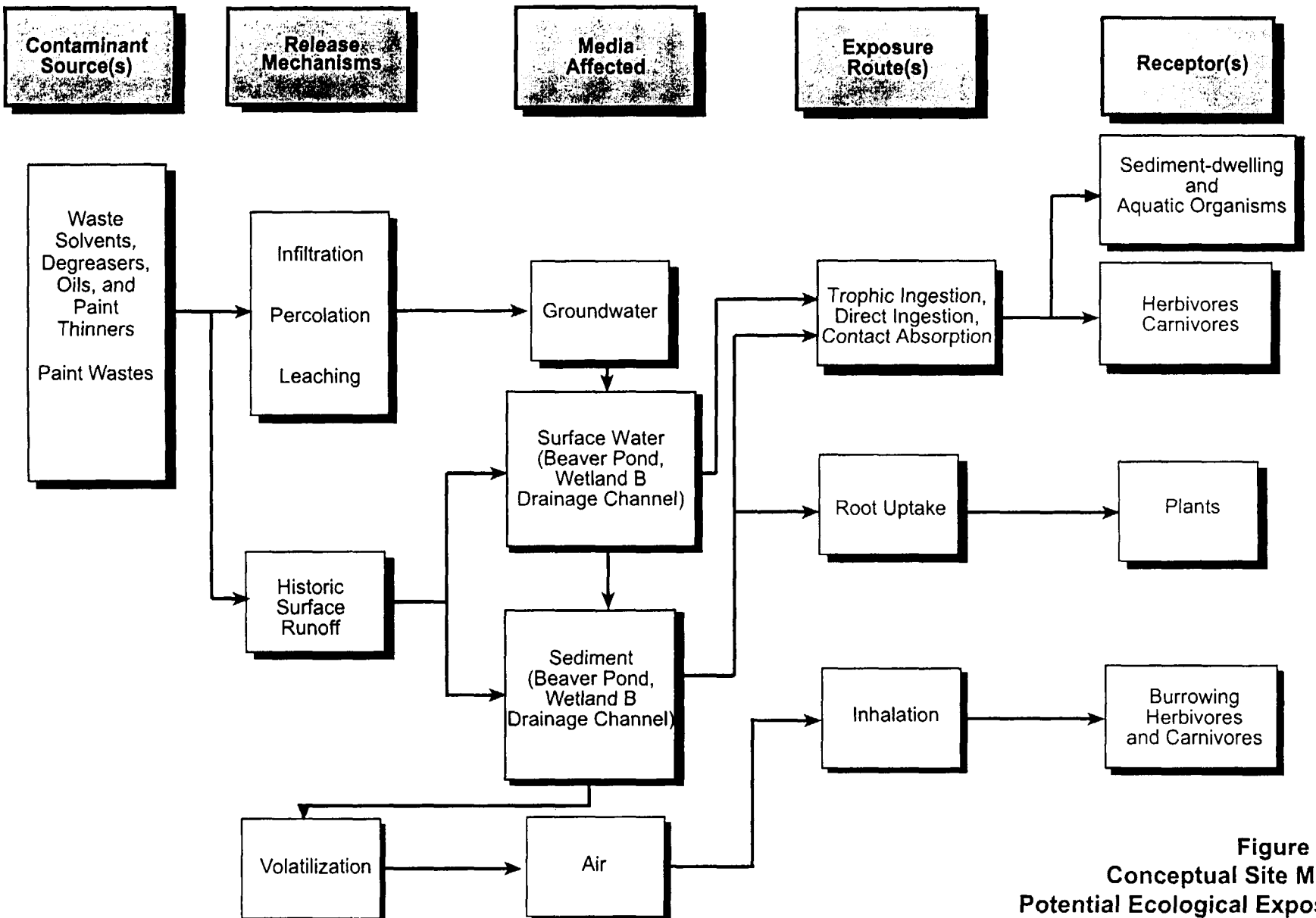


Figure 2-14
Conceptual Site Model
Potential Ecological Exposure
OU-1, Hanscom AFB, MA

CH2MHILL

Area and Hartwell Town Forest. There are deed restrictions on these lands which limit use to passive and/or active recreation use (per conversation with Ms. Elizabeth Bagdonas/Bedford Conservation Board).

There is also a small section of OU-1 which is owned by Hanscom AFB and is used as a campground and as the site of the central groundwater treatment facility for OU-1. The current Hanscom AFB Base Comprehensive Plan identifies this area as "Outdoor Recreation" in both the existing and future Land Use Plans. Water for the campground is provided by the Town of Lexington public water distribution system.

Groundwater beneath and directly downgradient to OU-1 is not currently used as a drinking water supply, and it is not expected to be so used in the future. Nonetheless, the groundwater beneath and directly downgradient to OU-1, and beneath and directly downgradient to the Hanscom AFB/Hanscom Field NPL Site as a whole, has been designated as GW-1 (i.e., as a potential future drinking water supply) under state law by means of a Town of Bedford Aquifer Protection District by-law that was enacted through a process authorized by and implementing the MCP. In addition, MADEP has classified the eastern side of OU-1, east of Runway 5-23, as an approved Zone II; under the state drinking water regulations (310 CMR 22.02), a Zone II is "that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated." Further in addition, the northeastern portion of the site at the northern end of Runway 5-23 is classified as a Potentially Productive Aquifer; the MCP defines "Potentially Productive Aquifer" in part as "all aquifers delineated by the U.S. Geological Survey (USGS) as a high or medium yield aquifer." As a result, MADEP has classified groundwater in this area as being of "high use and value." The MADEP Site Scoring Map is included as Figure 2-15.

A well inventory was conducted for Hanscom AFB as part of the IRP Stage 2 Remedial Investigation for OU-3 by M&E (June 1992). The objective of the well inventory was to identify and locate all public water supply wells, private drinking water wells, and industrial, irrigation, and monitoring wells within a three-mile radius of Hanscom AFB. Hanscom AFB met with the Town of Bedford Board of Health Director in October 2000 to review the location of wells installed after the M&E survey. These surveys revealed that the wells closest to OU-1 include several private wells located greater than 3000 feet northeast of the leading edge of the OU-1 groundwater plume. The closest active public wells are the Town of Bedford Shawsheen Road Wellfield located approximately 7,000 feet northeast of the leading edge of the OU-1 plume. The Hartwell Road wellfield, which is inactive, is located more than 2,500 feet north/northwest (crossgradient) of OU-1. These reviews have confirmed that no public or private wells have been installed in the plume area, within the Town of Bedford Hartwell Forest, or within 3000 feet in the downgradient direction (northeast) of the plume.

Community and stakeholder input was sought and incorporated through active outreach with the Restoration Advisory Board.

MA DEP - Bureau of Waste Site Cleanup

Site Scoring Map: 500 feet & 0.5 Mile Radii

SITE NAME:
Hanscom Air Force Base

[illegible]910n 711730ew

Site Location

The information shown on this map is the best available at the time of printing. Please refer to the data source in the [illegible] document.

MASSGIS — Massachusetts Geographic Information System — Massachusetts Executive Office of Environmental Affairs 2000

DEP

3023000-12G
3023000-10G
3023000-11G

CONCORD ROAD
HARTWELL ROAD
OLD BEDFORD ROAD
VIRGINIA ROAD
SHADYSIDE AVENUE
AIR
PINE HILL
BEDFORD
CONCORD
BEDFORD
LINCOLN
18

FIGURE 2-15

Roads: Limited Access, Divided, Major Road, Connector, Street, Track, Trail

Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct

Basins: Major, Sub; Streams: Perennial, Intermittent, Man Made Shore, Dams

Potentially Productive Aquifers: Medium,High Yield

Non-Potential Drinking Water Source Area: Medium,High Yield

EPA Designated Sole Source Aquifer

Public Water Supplies: Ground,Surface,Non Community

Approved Zone2; IWPA; Surface Water Supply Zone A

Hydrography: Water Features,Public Surface Water Supply

Wetlands: Fresh,Salt,NHESP Wetlands Habitat

Protected Open Space; ACEC

DEP Permitted Solid Waste Facilities; Certified Vernal Pools

N
W
E
S

SCALE 1:15000

0 0 1/2 1/2 MILES KILOMETERS

August 08, 2000

2.7 Summary of Site Risks

2.7.1 Human Health Risk Assessment

2.7.1.1 Potential Risks from Groundwater Contamination

Based on agreement between USEPA, MADEP and Hanscom AFB, a full baseline human health risk assessment was not conducted for OU-1. It was determined that COC concentrations in OU-1 groundwater exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards) at many locations, and that as a result there is an unacceptable risk to human health from groundwater ingestion.

2.7.1.2 Potential Risks from Soil Contamination

It was concluded by Hanscom AFB, USEPA and MA DEP that the risk associated with soil contamination at OU-1 was related to the potential for continued degradation of the quality of groundwater below OU-1. Construction worker direct contact exposure was not assessed as construction activities other than those associated with remedial efforts are not envisioned at these IRP sites on an active airfield. These areas are immediately adjacent to the runways, within the restrictive airfield area, and the only possible construction would be for utility services or associated with the remedial efforts (which would include a site-specific health and safety plan in accordance with OSHA (29 CFR 1910.120) and all other applicable federal, state, and local requirements). Further, in place remedial system piping and recharge basins at Site 2 and 3 would necessitate routing of utility services around the area with subsurface soil contamination. If construction activities are planned for the airfield area in the future, appropriate health and safety procedures will be followed, including the preparation of a site specific health and safety plan, in accordance with OSHA (29 CFR 1910.120) and all other applicable federal, state, and local requirements.

In order to assess the potential for continued degradation of groundwater quality from infiltration through soils within the OU-1 area, a soil-to-groundwater pathway analysis was conducted. The objective of this evaluation was to determine if additional remedial efforts were required to reduce or remove contaminants from the soils above the water table that are leaching into the groundwater.

The use of the soil-to-groundwater pathway analysis for evaluating potential human health concerns associated with OU-1 soil was discussed with and agreed to by USEPA Region 1 prior to implementation. USEPA- approved methodology was used to estimate potential groundwater concentrations based on available soil data. Data from the 1996 soil sampling at Sites 1, 2, and 3 discussed earlier were used in this evaluation.

Soil data were evaluated to estimate the potential groundwater concentration associated with the measured soil concentrations. The predicted groundwater concentrations were then compared with MCLs, which are federal and state drinking water standards. If an MCL was not available for a constituent detected in soil, the predicted groundwater concentration was compared with the MCP Method 1 GW-1 standard (310 CMR 40.0000). The predicted groundwater concentrations also were compared with groundwater concentrations measured in wells located within or downgradient from the three plume

source areas in OU-1. Calculated groundwater concentrations exceeding USEPA MCLs are presented in Table 2-3.

The results of the soil to groundwater modeling, evaluation of the LTSP groundwater monitoring, and comparisons with MCLs indicate that potential leaching from soil to groundwater may occur in some isolated areas of Sites 1 and 2 and to a much lesser extent at Site 3. The areas with the highest concentrations that may present a leaching concern are limited in size both laterally and vertically (i.e., within the soil column).

In general, the majority of estimated contaminant concentrations in groundwater based on the mean concentration for each site are below the corresponding drinking water standards. In many cases the estimated concentrations calculated using the maximum soil concentrations also are below these standards. A closer review of the soil data shows that the soil concentrations that do lead to an estimated groundwater concentration in exceedance of the drinking water standards are located in a limited area of the soil. For the most part, the estimated groundwater concentrations are similar to or greater than the concentrations measured during the LTSP in the surficial aquifer monitoring wells within or downgradient of the OU-1 Sites. Some of the constituents that were detected in soil samples have not been detected in groundwater. However, some of the constituents that have been detected in groundwater were not detected in soil.

Considering the results of the soil to groundwater evaluation, as well as the extensive groundwater data generated during the LTSP, it can be concluded that it is unlikely that residual levels of VOCs in soils at Sites 1, 2, and 3 are contributing significantly to the groundwater contamination identified in each of the areas. Furthermore, the locations where there is increased potential that VOCs in soils may be leaching to groundwater are highly localized. It should be noted that the locations of the soil borings that had concentrations of VOCs are located within the capture zones of the groundwater collection trenches associated with the OU-1 treatment system which is currently removing and treating contaminated groundwater from the surface aquifer at Site 1, 2, and 3. In viewing the data set as a whole at each site, it is apparent that the VOC detections that may pose a concern are not a widespread problem. Based on these results, the selected remedy addresses site soils by implementing institutional controls to ensure that future land use does not increase the risk of exposure to residual soil contamination in the plume source areas.

2.7.2 Ecological Risk Assessment

An Ecological Risk Assessment (ERA) was conducted to identify the risk that "chemicals of potential concern" (COPCs) may have upon ecological receptors in the vicinity of OU-1 (CH2M HILL, 1999).

This ERA used a phased approach, which consisted of:

- Problem Formulation
- Identification of Contaminants of Potential Concern
- Risk Questions
- Exposure and Effects Scenarios
- Risk Characterization

Table 2-3: Calculated Groundwater Concentrations exceeding EPA MCLs

Compound	EPA MCL (mg/L)	Site 1			Site 2			Site 3A			Site 3B		
		Maximum[a] (mg/L)	Mean[b] (mg/L)	Median[c] (mg/L)	Maximum[a] (mg/L)	Mean[b] (mg/L)	Median[c] (mg/L)	Maximum[a] (mg/L)	Mean[b] (mg/L)	Median[c] (mg/L)	Maximum[a] (mg/L)	Mean[b] (mg/L)	Median[c] (mg/L)
1,2-Dichloroethane	0.005	0.010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzene	0.005	NA	NA	NA	0.022	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	0.07	10.5	0.295	NA	0.202	NA	NA	NA	NA	NA	0.080	NA	NA
Tetrachloroethene	0.005	0.021	NA	NA	0.016	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	0.1	0.182	NA	NA	0.104	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	0.005	0.276	0.011	NA	6.42	0.207	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride*	0.005	NA	NA	NA	7.73	0.169	NA	0.029	0.021	NA	NA	NA	NA
m/p-Xylene	10	NA	NA	NA	NA	NA	NA	11.1	NA	NA	NA	NA	NA
Toluene	1	NA	NA	NA	NA	NA	NA	17.5	NA	NA	NA	NA	NA

Note: Groundwater concentrations were calculated using a soil to groundwater pathway model based upon existing residual soil contamination.

2.7.2.1 Problem Formation

During this phase of the ERA areas of ecological risk and receptors were identified. The final selection of receptors for OU-1 included sediment-dwelling organisms, aquatic organisms, and the beaver. Sediment and aquatic organisms are exposed directly to the media of concern (sediment and surface waters) within the Wetland B/beaver pond. Figure 2-12 presents the location of the Wetland B/beaver pond, and locations of the sediment and surface water samples collected for the ERA. Within their daily routine, beaver would be exposed to VOCs through all exposure pathways: ingestion, absorption, and inhalation. This phase of the ERA also created the Ecological Conceptual Site Model presented as Figure 2-14.

2.7.2.2 Identification of Contaminants of Potential Concern

Chemicals of potential concern (COPCs) were identified using a series of steps. These steps involved identification of conservative ecological screening thresholds (concentrations of compounds shown in the literature to cause adverse ecological effects relevant to the appropriate assessment endpoint) for each medium and comparison of maximum media concentrations of detected contaminants to the screening thresholds through the use of hazard quotients (HQs), the ratio of media concentrations to screening thresholds). COPCs evaluated in the OU-1 ERA are presented by media in Tables 2-4 and 2-5.

This screening process resulted in the elimination of most COPCs for each of the receptor groups. Lead and copper were identified as COPCs for sediment-dwelling organisms. Lead in surface water was identified as a COPC for both surface water organisms and semi-aquatic organisms such as the beaver. The HQ for cadmium in surface water was only slightly above 1.0 and was only detected in one of five samples; therefore, cadmium was not included as a COPC and was not investigated further. Volatile organic compounds (VOCs) were not identified as COPCs for either sediment or surface water organisms. The exposure of beaver to inhalation of VOCs within their dens, however, was evaluated for possible effects on beaver, because of the nature of the confined space inside the dens where VOCs can accumulate.

2.7.2.3 Exposure and Effects Scenarios

The Exposure and Effects Scenarios phase of the ERA was performed for each COPC and, with regard to the potential for inhalation by beaver only, for VOCs.. This entailed determining whether and how receptor groups are exposed to COPCs and VOCs and then characterizing the possible adverse effects for contaminant levels exceeding published toxic levels. Exposure pathways identified during the OU-1 ERA are presented below in Table 2-6. To evaluate further the potential effects of lead on beaver, a model was created to determine the average daily lead and copper exposure to the beaver. An inhalation model also was created to determine the average daily dose of VOCs to beaver.

2.7.2.4 Ecological Risk Characterization

In the Risk Characterization phase of the ERA, exposure concentrations determined from the exposure models were compared to values documented to cause adverse effects. The Screening Toxicity Values used in this process are presented for each contaminant in Tables 2-4 and 2-5.

TABLE 2-4
Ecological Risk Assessment
Occurrence, Distribution, and Selection of Chemicals of Concern (COC)

Exposure Medium: Sediment								
Chemical of Potential Concern	**Min. Conc. (ppb)**	**Max. Conc. (ppb)**	**Ave. Conc. (ppb)**	**Location Maximum Detection**	**Lower Threshold Value (ppb)**	**Threshold Value Source**	**HQ Value[1]**	**COC Flag Y or N**
Chloromethane	-	5.0	3.0	SS202	-		NA	N
Acetone	-	240.0	123.8	SS203	1623	H&S	0.15	N
1,2-Dicholoroethene (total)	-	28.0	10.5	SS203	150000	D	0.0002	N
2- Butanone	-	100.0	52.2	SS203	270	ORNL	0.37	N
Trichloroethene	-	22.0	7.1	SS203	220	ORNL	0.10	N
Toluene	-	560.0	247.0	SS205	19933	H&S	0.03	N
Ethylbenzene	-	10.0	4.1	SS202	110570	H&S	0.0001	N
Copper	-	25000	16400	SS202&3	16000	P	1560	Y
Lead	-	100000	61800	SS204	31000	P	3230	Y
Zinc	-	47000	33400	SS204	120000	P	390	N

Key:

Conc. = Concentration
- = Not Available
Averages were calculated using one-half the detection limit for nondetects
Although not detected, one-half of cadmium's detection limits exceed the lower screening benchmark.
H&S = Hull & Suter, 1994. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment Associated Biota: 1994 Revision.
P = Persuad et al. 1994. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment.
D = USDOE, 1994. Loring AFB Risk Assessment Methodology. US Department of Energy. DE/AC05/840R21400.
ORNL = ORNL, 1997. Oak ridge National Laboratory, Equilibrium partitioning-derived sediment quality benchmarks, based on conventional aqueous benchmarks presented in Suter and Tsao (1996).

Notes:

1 Hazard Quotient (HQ) is defined as Maximum Concentration/ Screening Toxicity Value.

TABLE 2-5
Ecological Risk Assessment
Occurrence, Distribution, and Selection of Chemicals of Concern (COC)

Exposure Medium: Surface Water								
Chemical of Potential Concern	**Min. Conc. (ppm)**	**Max. Conc. (ppm)**	**Ave. Conc. (ppm)**	**Location Maximum Detection (ppm)**	**Chronic Screening Toxicity Value2 (ppm)**	**Chronic Screening Toxicity Value Source**	**HQ Value[1]**	**COC Flag Y or N**
Chloromethane	-	1.4	0.68	RAP1-SW11	NA	NA	NA	N
Acetone	-	10	6.25	Sw202	1500	S&M	0.01	N
1,2-Dichloroethene (total)	-	3.8	1.38	RAP1-SW4	590	S&M	0.01	N
2- Butanone	-	10	6.25	Sw202	14000	S&M	0.00	N
Trichloroethene	-	4	1.40	RAP1-SW4	47	S&M	0.09	N
Toluene	-	8.5	2.12	Sw202	10	S&M	0.85	N
Cadmium	-	1.4	0.68	Sw201	1.2	EPA	1.17	Y
Copper	-	36	15.30	Sw202	13.8	EPA	2.61	Y
Lead	-	59	27.72	Sw201	3	EPA	19.7	Y
Zinc	-	64	38.60	Sw201	121	EPA	0.53	N

Key:

Conc. = Concentration
- = Not Available
S&M = Suter and Mabrey, 1996. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Aquatic Biota: 1996 Revision.
EPA = EPA (NAWQC, 40 CFR 131-36)

Notes:

[1] Hazard Quotient (HQ) is defined as Maximum Concentration/ Screening Toxicity Value.
[2] Maximum Screening Benchmark for VOCs are Tier II values (Suter and Mabrey, 1996); values for metals are the freshwater National Ambient Water Quality Criteria (NAWQC) derived using the hardness at the location of maximum concentration.

TABLE 2-6
Ecological Exposure Pathways of Concern

Exposure Medium	Sensitive Environment Flag Y or N	Receptor	Endangered/ Threatened Species Flag Y or N	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Sediment	Y	Benthic organisms	N	Absorption and ingestion of chemicals in sediment	Abundance and diversity	Concentrations below sediment quality thresholds, which have been documented to be protective of sediment dwelling organisms.
		Beaver Community	N	Ingestion of chemicals in sediment	Beaver survival and recruitment	Concentrations below toxic inhalations and dietary dose thresholds, which have been documented to be protective of beaver.
Surface Water	Y	Aquatic Organism	N	Absorption and ingestion of surface water.	Growth and survival of water column populations	Concentrations below water quality thresholds, which have been documented to be protective of organisms inhabiting the water column.
		Beaver Community	N	Normal daily ingestion of surface water.	Beaver survival and recruitment	Concentrations below toxic inhalations and dietary dose thresholds, which have been documented to be protective of beaver.

Several points of uncertainty were associated with the models used in exposure assessment for beavers. In addition, it should be recognized that other potential sources exist for the lead present in the beaver pond surface water.

Based on the phased approach of this ERA, the following conclusions were drawn:

1. There is no risk to benthic organisms (e.g., chirnomids- midge larvae, tricoptera- caddis fly larvae) within OU-1 from either metals or VOCs in sediment.
2. There is no risk to aquatic dwelling organisms (e.g., fish, tadpoles) within OU-1 from VOCs.
3. Risk to individual aquatic organisms (e.g., fish, tadpoles) from lead is possible due to exceedance of National Ambient Water Quality Criterion (NAWQC); however, given the high variability of the data, area of exceedance, and ecological observations of the system, there does not appear to be an unacceptable risk at the population or community level. There is, however, considerable uncertainty in this conclusion which stems from the following factors:
    - Concentrations varied across the Wetland B/beaver pond.
    - Hardness (carbonates in the water as measured by calcium carbonate content) between sites varied with the maximum being seven times higher than the minimum. This resulted in varying NAWQC values.
    - No concentrations were above acute NAWQC.
4. There is no risk to beaver at OU-1 from either metals or VOCs.
5. To address these areas of uncertainty and the possibility that sediment may be the source contributing to the elevated concentrations of lead and copper, two additional rounds of sampling will be performed in Wetland B/beaver pond as part of the selected interim remedial action for the OU-1 area. During each round, a total of three samples will be collected from three locations: upgradient, the area of highest concentrations, and downgradient. In addition to copper and lead analyses, the sediment samples will be analyzed for acid volatile sulfides and simultaneously extracted metals (AVS/SEM) to assess the bioavailability of these metals. Surface water samples will be analyzed for hardness, and total and dissolved fractions of copper and lead.

A more detailed presentation of the Ecological Risk Assessment is given in the Final Ecological Risk Assessment report (CH2M HILL, 1999).

2.7.3 Basis for Response Action

It was determined that COC concentrations in OU-1 groundwater exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards) at many locations, and that as a result there is an unacceptable risk to human health from groundwater ingestion. Therefore, actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this IROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

2.8 Remediation Objectives

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment. The RAOs for the selected remedy for OU-1 are:

- Prevent exposure (via ingestion, inhalation and/or dermal contact) to groundwater containing COC concentrations that exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards).
- Prevent further migration of dissolved-phase COCs in groundwater.
- Prevent discharge of groundwater containing COC concentrations that exceed federal drinking water standards, state drinking water standards and state groundwater risk characterization standards to surface water bodies and wetlands.

A secondary objective of the cleanup activities is to decrease contaminants near the source area and to reduce the size of the off-site dissolved phase plume, i.e., draw back the plume toward the source areas.

The RAOs are meant to reduce the potential exposure of humans to VOCs in groundwater that are present in concentrations that exceed federal and state drinking water standards and state groundwater risk characterization standards and pose an unacceptable risk to human health and the environment. While contaminated soil remedial measures are not stated objectives of this interim remedial action, institutional controls being implemented will also prevent human exposure to residual subsurface soil contamination in the plume source areas which could pose an unacceptable risk to human health.

2.9 Development and Screening of Alternatives

2.9.1 Statutory Requirements/Response Objectives

Under its legal authorities, USEPA's primary responsibility at Superfund sites is to ensure that remedial actions are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that Air Force's remedial action, when complete, must comply with all federal and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that Air Force select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

2.9.2 Technology and Alternative Development and Screening

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a FFS was conducted for the site based on the following:

- Several remedial actions have already been conducted at the site to address known sources at OU-1. The remedial actions consisted of contaminated soil excavation to the water table at Site 1, and buried drum and contaminated soil excavation to the water table at Sites 2 and 3. These remedial actions were conducted under State authority prior to the listing of Hanscom AFB on the NPL.

- An effective groundwater remediation and plume containment system has already been installed at OU-1. The system was included in the IRP Remedial Action Plans for Sites 1, 3 and 3/5 that were developed/implemented in the 1980s under MADEP oversight. The system commenced operation in April 1991 and has been operated around-the-clock since then. Groundwater quality has been monitored in the three aquifers below OU-1 (upper, lower, and bedrock) through the LTSP. A total of 13 rounds of sampling have been conducted within the OU-1 area dating back to 1986. The LTSP was designed to further assess the nature and extent of groundwater contamination and the effects of the groundwater collection trenches/interceptor wells and treatment system. The results of the LTSP have demonstrated that the groundwater remediation system is effective at removing contaminant mass. In addition, the water quality and groundwater flow data collected at the boundary wells on the leading edge of the plume indicate that the remedial system is effective in containing contaminant migration in each of the surface, lower and bedrock aquifers. Therefore, it has been demonstrated over recent years that the existing system is a feasible technology in removing contaminant mass and retarding the migration of the contaminant plume.

It was decided that the scope of this focused FS would be to evaluate the following remedial alternatives in detail:

- Alternative G-1—No Action
- Alternative G-2—Limited Action – Institutional Controls and Monitoring
- Alternative G-3—Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring

2.10 Description of Alternatives

Each remedy discussed in this section was designed to address threats posed by contaminated groundwater found below OU-1. As described in Section 2.9, Development and Screening of Alternatives, it was decided between USEPA, Hanscom AFB and DEP that three remedies would be evaluated in the focused FFS. The remedial remedies considered, including the no action remedy, are summarized below. A more complete, detailed presentation of each remedy is found in Section 4.2 of the FFS.

Remedial alternatives to address residual soil contamination at Sites 1, 2 and 3 were not evaluated in the FFS, however, institutional controls associated with Remedy G-2 and G-3

would be protective of human health. The results of a soil to groundwater model concluded that the residual levels of VOCs detected in soils above the water table are not likely to have a significant adverse impact on ground water quality below Sites 1, 2, and 3. In addition, remedial alternatives to address residual soil contamination at Sites 5 and 20 were not evaluated in the FFS because it was decided that no further action under CERCLA was appropriate for these two sites.

OU-1 Groundwater Remedies

The remedial alternatives selected for detailed analysis for the OU-1 groundwater are as follows:

- Remedy G-1—No Action
- Remedy G-2—Limited Action – Institutional Controls and Monitoring
- Remedy G-3—Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring

Table 2-7 summarizes the three remedies evaluated in the Focused Feasibility Study.

2.10.1 Remedy G-1—No Action

Description of No Action Remedy

Under this remedy (which is required to be evaluated by law in all Feasibility Studies and Proposed Plans), no further effort or resources would be expended at the Hanscom AFB OU-1 site. This remedy calls for stopping operation of the existing OU-1 groundwater remediation system that originally was started in 1991. Several changes have been made to the system since 1991. The groundwater remediation system currently consists of three groundwater collection trenches in the surficial aquifer, ten interceptor wells screened in the lower and/or bedrock aquifers, a four-well vacuum enhanced recovery system screened in the bedrock aquifer, a groundwater treatment facility and on-site recharge/off-site discharge facilities. A detailed description of the groundwater remediation system is presented in Section 4.2.3. of the Focused Feasibility Study. A long term groundwater sampling program has been in effect since 1986. Remedy G-1 does not include any additional system operation or groundwater monitoring.

No Action would not achieve the chemical-specific ARARs within the groundwater plume at OU-1 because federal and state MCLs, federal MCLGs and state MCP Method 1 GW-1 standards will not be met in the short-term. There are no location-specific or action-specific ARARS for Remedy G-1.

Groundwater Flow and Solute Transport Models have been used to simulate this No Action Remedy. The models indicated that a steady-state condition for the migration of the contaminant plume is reached after approximately 100 years. Once the steady-state condition is achieved, the contaminant plume is not expected to migrate any farther. A description of the groundwater flow and solute transport models, along with the No Action model simulation, is included in the Focused Feasibility Study. It should also be noted that it is difficult at this time to predict when the Remedial Action Objectives will be met under this remedy, and if they will ever be met under this remedy.

TABLE 2-7
Information Summary for the 3 Remedies

Remedial Alternative	Long Term Reliability	Untreated Waste	Time for Design, Construction, and/or Implementation (yrs)	Time to Reach Remediation Goals (yrs)	Costs	Expected Outcome
Remedy G-1 – No Action	NA	No treatment undertaken. Therefore, all contaminants remain onsite.	0	100 yrs to reach steady state conditions, not attain remediation goals.	Capital = $0 O&M = $0 Total present worth = $0 Discount rate = 5% Yrs remedy cost projected over = 30	No use of groundwater and no change in land use in the foreseeable future.
Remedy G-2 – Limited Action – Institutional Controls and Monitoring	NA – only monitoring	All contaminants remain onsite.	0-1	100 yrs to reach steady state conditions, not attain remediation goals.	Capital = $0 O&M = $87,264 first year, $65,184 every year after 5 yr reviews = $25,000 Total present worth = $1,143,770 Discount rate = 5% Yrs remedy cost projected over = 30	No use of groundwater and no change in land use in the foreseeable future.
Remedy G-3 – Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring	Very reliable, system has been operating since 1991.	Contaminated groundwater is pumped to a the on-site water treatment plant which has a capacity of 320 gpm. The treated water is discharged to the drainage channel or recharge basins.	0-1	Groundwater collection, treatment, and discharge system can effectively contain spread of contaminant plume. Drawback of plume expected over time (> 30 years)	Capital = $0 O&M = $586,320 first year, $564,240 every year after 5 yr reviews = $25,000 Total present worth = $9,199,070 Discount rate = 5% Yrs remedy cost projected over = 30	No change in land use in the foreseeable future. Off-site groundwater (within Bedford's Jordan Conservation Area/Hartwell Town Forest) available for use as plume is pulled back to original contaminant release areas.

Because contaminated media would be left on the site, a review of the site conditions would be required every 5 years. The review is specified in the National Contingency Plan (NCP). Remedy G-1 serves as the baseline against which the effectiveness of other remedies is judged.

2.10.2 Remedy G-2—Limited Action – Institutional Controls and Monitoring

Description of Remedy G-2

This remedy calls for ceasing operation of the existing groundwater remediation system at OU-1, and monitoring groundwater contaminant concentrations throughout OU-1. This remedy is similar to Remedy G-1 except that a groundwater monitoring program will be implemented to monitor contaminant plume migration and institutional controls (ICs) will be put in place.

Under this remedy, institutional controls will be put in place to establish adequate safeguards that control access to contaminated groundwater and soil. Institutional controls for portions of OU-1 located on Hanscom AFB property, such as the campground, will include the addition of groundwater and land use restrictions to the Base Comprehensive Land Use Plan for Hanscom AFB. These ICs will be implemented and enforced by Hanscom AFB. Hanscom AFB will have ultimate responsibility for ensuring that these controls, as a component of the selected remedy, continue to be in place and are effective and protective of human health and the environment. For those portions of OU-1 located on MASSPORT property (the majority of the site), a Memorandum of Understanding will be sought with MASSPORT by Hanscom AFB stating that:

- Groundwater in OU-1 cannot be used for consumptive use; and
- Excavation of soils in the three source areas will be controlled.
- For those portions of OU-1 located on Town of Bedford property a Memo of Understanding will be sought with the Town of Bedford by Hanscom AFB:
- Acknowledging the groundwater contaminant plume;
- Preventing the consumptive use of groundwater; and
- Controlling (preventing) the issuance of groundwater well permits for land within OU-1.

For those portions of OU-1 located on Town of Bedford property a Memorandum of Understanding will be sought with the Town of Bedford by Hanscom AFB:

- Acknowledging the groundwater contaminant plume;
- Preventing the consumptive use of groundwater; and
- Controlling (preventing) the issuance of groundwater well permits for land within OU-1.

- A long-term sampling program (LTSP) has been in effect for OU-1 since 1986. The monitoring wells used in the LTSP are depicted in Figures 2-4 through 2-11 and the surface water sampling locations are illustrated in Figure 2-12. This remedy includes the continuation of groundwater monitoring at OU-1, but in a reduced number of selected monitoring wells and surface water sampling locations. The monitoring wells that would be included in the LTSP for this remedy would be selected based upon their geographical location, aquifer, and distribution across the site.

In addition, the Air Force would collect surface water samples from the five sample points that have been sampled in recent rounds: SW4, SW11, SW201, SW202, and SW203. This sampling would be included in the LTSP to determine whether water quality in the Wetland B/beaver pond area was being affected by contaminated groundwater migrating from the upper aquifer as well as discharge from the groundwater treatment system to the drainage channel. The groundwater and surface water samples would be analyzed for VOCs using USEPA methodology. Samples also would be analyzed for hardness and total and dissolved lead. The samples would be analyzed for hardness because the screening thresholds for metals in surface water are dependent upon water hardness.

The Ecological Risk Assessment indicated some uncertainty about whether sediment may be the source contributing to the elevated concentrations of lead and copper in surface water collected in the Wetland B/beaver pond area. As a result, additional sediment and surface water sampling in this area would be included as part of the LTSP. The uncertainty would be addressed by collecting three additional sediment and surface water samples during the 1999 and 2000 LTSP rounds as discussed previously in the Risk Assessment section.

Groundwater flow and solute transport models have been used to simulate this remedy, which includes ceasing operation of the existing groundwater remediation system. The models have indicated that a steady-state condition for the migration of the contaminant plume is reached after approximately 100 years. Once the steady-state condition is achieved, the contaminant plume is not expected to migrate any further. A description of the groundwater flow and solute transport models, along with the model simulation, is the same as the No Action Remedy described in the Focused Feasibility Study.

This remedy would not achieve the chemical-specific ARARs within the groundwater plume at OU-1 because federal and state MCLs, federal MCLGs and state MCP Method 1 GW-1 standards will not be met in the short-term. There are no location-specific ARARS for Remedy G-2. The remedy would comply with all action-specific ARARs, including federal Ambient Water Quality Criteria and the Massachusetts Surface Water Quality Standards.

Because contaminated media would be left on the site in concentrations above levels that allow unrestricted exposure and unlimited use, a review of the site conditions would be required every 5 years. Each review will involve site sampling and inspections as well as a data evaluation with summary report. The review is specified in CERCLA and the NCP.

2.10.3 Remedy G-3 – Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring

Description of the Existing Remediation System

The groundwater remediation system at OU-1 started operating in 1991. It originally consisted of three groundwater collection trenches in the surficial aquifer and four boundary interceptor wells, screened in both the lower and bedrock Aquifers. The extracted groundwater is piped to a groundwater treatment plant for treatment by air stripping, and is then discharged either to recharge basins at Sites 2 and 3, and/or to a drainage ditch which flows into the wetlands north of the Hanscom Field runways. The elements of the groundwater remediation system are shown in Figure 2-2.

In recent years, the groundwater remediation system has been considered a dynamic operation with enhancements being made in the system elements and in the operation and pumping rates of the individual components. In 1997, two interceptor wells were installed near the contaminant source areas at Sites 1 and 2. An experimental vacuum enhanced recovery (VER) system was also installed to accelerate the removal of contaminant mass from the bedrock aquifer at Site 1. In 1999, three monitoring wells associated with the Site 1 VER system were converted to conventional interceptor wells to augment the VER effort and an interceptor well was installed in the center of Burn Pit #2 at Site 1. Additional changes and additions, aimed at improving the effectiveness of groundwater remediation are expected to be made in the future, as suggested by operational experience and monitoring. A detailed description of the groundwater treatment system is presented in Section 2.12, The Selected Remedy, of this IROD.

Groundwater Monitoring

An extensive network of groundwater monitoring wells has been installed at OU-1 to define the nature and extent of contamination, to design the collection system, and to monitor the effectiveness of the remedial system. Groundwater sampling was initiated in 1986. To date, 13 major rounds of sampling have been performed, at the times listed in Table 2-8 below. Each round has included both water-level measurements in monitoring wells and the collection of groundwater samples for VOC analysis. The monitoring wells used in the LTSP are depicted in Figures 2-4 through 2-11 and the surface water sampling locations are illustrated in Figure 2-12.

TABLE 2-8
Schedule of Past Long Term Sampling Rounds

Round No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Date (Mo./Yr.)	2/86	10/87	9/88	11/90	2/91	8/91	6/94	11/94	7/96	5/97	5/98	5/99	11/99

This remedy includes the continuation of groundwater monitoring at OU-1, but in a reduced number of selected monitoring wells and surface water sampling locations. The LTSP for this remedy is a two-phase approach. The first is the formal annual sampling of 40 selected wells to confirm the containment of the OU-1 plumes. The second phase of the LTSP is the sampling of collection sources and monitoring wells for screening by the operations and maintenance (O&M) staff using an on-site gas chromatograph (GC). The purpose of this sampling and analysis is for system optimization and to identify trends in the level of VOCs at groundwater recovery points and within the OU-1 plumes. A more detailed description of the LTSP is presented in Section 2.12, The Selected Remedy, of this IROD.

The LSTP for this remedy includes the laboratory analysis of fewer samples than Remedy G-2, but, when combined with the on-site screening, will provide more data to assess the effectiveness of the remedial effort and progress towards a permanent solution.

In addition, a surface water sample will be collected from one of the sample points that has been sampled in each LTSP Round: RAP1-SW4. This sampling will be included in the LTSP to determine whether water quality in the Wetland B/beaver pond Area is being impacted by contaminated groundwater migrating from the upper aquifer as well as discharge from

the groundwater treatment system to the drainage channel. The surface water sample will be analyzed for VOCs using USEPA Method 8260A.

As discussed in Section 2.7, Summary of Site Risks, some uncertainty was raised in the Ecological Risk Assessment regarding the possibility that sediment may be the source contributing to the elevated concentrations of lead and copper in the Wetland B/beaver pond. As a result, additional sediment and surface water sampling has been included in the LTSP. The uncertainty will be addressed by collecting three additional sediment and surface water samples during the 1999 and 2000 LTSP rounds.

Institutional Controls

Under this remedy, institutional controls will be put in place to establish adequate safeguards that control access to contaminated groundwater and soil. Institutional controls for portions of OU-1 located on Hanscom AFB property, such as the campground, will include the addition of groundwater and land use restrictions to the Base Comprehensive Land Use Plan for Hanscom AFB. These ICs will be implemented and enforced by Hanscom AFB. Hanscom AFB will have ultimate responsibility for ensuring that these controls, as a component of the selected remedy, continue to be in place and are effective and protective of human health and the environment. For those portions of OU-1 located on MASSPORT property (the majority of the site), a Memorandum of Understanding will be sought with MASSPORT by Hanscom AFB stating that:

- Groundwater in OU-1 cannot be used for consumptive use; and
- Excavation of soils in the three source areas will be controlled.

For those portions of OU-1 located on Town of Bedford property a Memorandum of Understanding will be sought with the Town of Bedford by Hanscom AFB:

- Acknowledging the groundwater contaminant plume;
- Preventing the consumptive use of groundwater; and
- Controlling (preventing) the issuance of groundwater well permits for land within OU-1.

Interim Remedial Action

Remedy G-3 provides for containment of the groundwater plume and some reduction in contaminant mass. This remedy is intended to be an interim remedial action. Additional information will be gathered to support a final remedy that will be targeted at remediating all or part of the plume by various means such as monitored natural attenuation, technical impracticality waivers, the establishment of compliance zones, and the implementation of new technologies to reduce or eliminate the source area contamination.

This remedy could comply with chemical-, location-, and action-specific ARARs for captured groundwater, as well as groundwater in the Upper, Lower, and Bedrock Aquifers over time. However, an interim action (ARAR) waiver under CERCLA 121(d)(4)(a) is necessary because this remedy is considered an interim action and will not meet Federal and State drinking water standards initially.

2.11 Summary of the Comparative Analysis of Alternatives

Section 121(b)(1) of CERCLA presents several factors that at a minimum the USAF is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

2.11.1 Nine Evaluation Criteria

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a site remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These criteria are summarized as follows:

2.11.1.1 Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with applicable or relevant and appropriate requirements (ARARs)** addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked.

2.11.1.2 Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. **Long-term effectiveness and permanence** addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.

5. **Short term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

2.11.1.3 Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after USEPA has received public comment on the RI/FS and Proposed Plan:

8. **State acceptance** addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

2.11.2 Comparative Analysis

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in Tables 4-1 (presented as Table 2-9 below) and 4-4 of the FFS.

2.11.3 Narrative Summary

The section below presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis.

2.11.3.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

- Alternative G-1 – No Action - does not provide long-term protection of human health and the environment. This alternative does not provide protection from groundwater contaminant concentrations exceeding chemical-specific ARARs. Groundwater contamination would continue to migrate at present levels. Alternative G-1 does not have the ability to meet the RAOs.

- Alternative G-2 – Limited Action – Institutional Controls and Monitoring, which would be effective in tracking the downgradient extension of the plume of contaminated groundwater. The plume is expected to extend further downgradient before reaching a steady-state condition for alternatives G-1 and G-2, because the release of contaminants to groundwater will remain an on-going process at OU-1. ICs can be implemented to control the potential access and exposure to contaminated media, but without other measures to control the sources of contamination, it is likely that the plume would persist and increase for an extended period of time. Alternative G-2 will prevent exposure to contaminated groundwater, however, will not meet the other RAOs.

- Alternative G-3 – Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring would achieve overall protection of human health and the environment in the long-term by the interception, removal, and treatment of contaminated groundwater from the OU-1 source areas. This alternative protects

TABLE 2-9
Comparative Evaluation of Interim Alternatives to Nine CERCLA Criteria

	Alt.1	Alt. 2	Alt. 3
Evaluation Criteria	**No Action**	**Limited Action – Institutional Controls and Monitoring**	**Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring**
Relevant Section in Feasibility Study	4.2.1	4.2.2	4.2.3
Threshold Criteria			
Overall Protection of Human Health and the Environment	○	◖	●
Compliance with ARARs	○	○	◖
Primary Balancing Criteria			
Long-Term Effectiveness and Permanence	○	○	◖
Reduction of Toxicity, Mobility, or Volume Through Treatment	○	○	●
Short-Term Effectiveness	●	●	●
Implementability	●	●	●
Cost - Present worth ($)	0	1,143,770	9,199,070
Modifying Criteria			
State Acceptance	○	○	●
Community Acceptance	○	○	●

● Meets or exceeds criteria ○ Does not meet criteria

◖ Partially meets criteria TBD = To be determined

human health and the environment by hydraulically confining the plume of dissolved contaminants and preventing contaminant migration to potential exposure points. Continued operation of the existing remediation system will draw contamination back from Bedford Town Forest and reduce the concentration of potential groundwater discharges to surface water. The implementation of ICs will serve to control the potential access and exposure to contaminated media within the OU-1. Monitoring groundwater within OU-1 will serve as an early warning system. Alternative G-3 has the ability to meet all three of the RAOs, prevent exposure to contaminated groundwater, prevent migration of contaminated groundwater, and prevent discharge of contaminated groundwater to surface water bodies.

2.11.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address hazardous substances, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which, while not applicable to the hazardous materials found at the site, the remedial action itself, the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for a invoking waiver.

- Alternative G-1 – No Action would not achieve the chemical-specific ARARs within the groundwater plume at OU-1 because federal and state MCLs, federal MCLGs and state MCP Method 1 GW-1 standards will not be met in the short-term. There are no location-specific or action-specific ARARS for Alternative G-1.
- Alternative G-2 – Limited Action – Institutional Controls and Monitoring would not achieve the chemical-specific ARARs within the groundwater plume at OU-1 because federal and state MCLs, federal MCLGs and state MCP Method 1 GW-1 standards will not be met in the short-term. There are no location-specific ARARS for Alternative G-2. The alternative would comply with all action-specific ARARs, including federal Ambient Water Quality Criteria and the Massachusetts Surface Water Quality Standards.
- Alternative G-3 – Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring could comply with chemical-, location-, and action-specific ARARs for captured groundwater, as well as groundwater in the Upper, Lower, and Bedrock Aquifers over time. However, an interim action (ARAR) waiver

under CERCLA 121(d)(4)(a) will be necessary because this alternative is considered an interim action and will not meet Federal and State drinking water standards initially.

2.11.3.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

- Alternative G-1 – No Action does not provide long-term effectiveness and permanence for groundwater. There would be no containment of the current plume, which is expected to extend further. There is also no monitoring program that could be used to track the migration of the plume, and provide a warning against increased risks.
- Alternative G-2 – Limited Action – Institutional Controls and Monitoring alone would not be effective in the long-term. Without a reduction in the source areas, contamination concentrations are expected to increase, and the plume is expected to migrate further before a steady-state condition is achieved.
- Alternative G-3 – Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring will continue to effectively protect human health and the environment as long as the remedial system continues to operate. If remediation is terminated without removal of the residual DNAPL sources, contaminants are expected to migrate slowly away from the source areas into Bedford Town Forest, where they will discharge to surface water and biodegrade, eventually reaching a steady-state condition. This alternative does not provide permanent aquifer restoration; it is primarily an interim containment remedy with limited, secondary objectives of source area DNAPL removal and plume capture. A subsequent action to address DNAPL sources and aquifer restoration/plume removal would be the subject of a final ROD.

Five year reviews would be necessary to evaluate the effectiveness of any of these alternatives because hazardous substances would remain on-site in concentrations above levels that allow unrestricted exposure and unlimited use.

2.11.3.4 Reduction of Toxicity, Mobility, and Volume

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

- Alternative G-1 – No Action and Alternative G-2 – Limited Action – Institutional Controls and Monitoring do not provide any reduction in toxicity, mobility, and volume through treatment. Alternatives G-1 and G-2 would actually result in an increase in groundwater contaminant concentrations and plume migration before a steady-state condition is achieved.
- Alternative G-3 – Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring provides reduction in toxicity, mobility, and volume in OU-1 by removing and treating contaminated groundwater. Alternative G-3 provides for the containment of the groundwater plume and some reduction in contaminant mass. This alternative is intended to be an interim remedial action. More

information will be gathered to support a final remedy that will be targeted at remediating all or part of the plume by various means such as monitored natural attenuation, technical impracticability waivers, and/or the establishment of compliance zones, and the implementation of new technologies to reduce or eliminate the source area contamination.

2.11.3.5 Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

- Alternative G-1 – No Action, and Alternative G-2 – Limited Action-Institutional Controls and Monitoring involve no construction or site activities and therefore would produce no disturbance to the surrounding community and environment.
- A temporary increase in air emissions, fugitive dust, and construction traffic on nearby roads would occur during potential modifications to the groundwater treatment system under Alternative G-3 – Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring. Construction workers would be required to use personal protective equipment (PPE).

2.11.3.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other government entities are also considered.

- Implementability is not applicable to Alternative G-1 – No Action. Alternative G-2 – Limited Action-Institutional Controls and Monitoring is readily implemented. Alternative G-3 – Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls, and Monitoring is also readily implemented since the groundwater collection and treatment system is already operating, and any future system modifications or enhancements will be done using standard construction practices and readily available equipment.
- Five-year reviews would be required for Alternatives G-1 – No Action, and Alternative G-2 – Limited Action-Institutional Controls and Monitoring, because contaminated groundwater would remain on the site in concentrations above levels that allow unrestricted exposure and unlimited use under each circumstance. Five-year reviews would also be required for Alternative G-3 – Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls, and Monitoring, during operation of the system, and as long as contaminated groundwater remains at the site.

2.11.3.7 Cost

Under the NCP, cost is a primary balancing criterion. Total present worth costs (for 30 years at a 5% discount rate) for the three alternatives for OU-1 groundwater range from negligible for Alternative G-1—No Action to $1,143,770 for G-2—Limited Action-Institutional Controls

and Monitoring, to $9,199,070 for G-3—Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls, and Monitoring.

The total costs for the groundwater alternatives include capital costs, operation and maintenance costs, and a total present-worth cost.

2.11.3.8 State / Support Agency Acceptance

The State has expressed its support for Alternative 3 (see Appendix E). The State does not believe that Alternatives 1 or 2 provide adequate protection of human health and the environment.

2.11.3.9 Community Acceptance

During the public comment period, the community expressed its support for Alternatives 3. Alternatives 1 and 2 were not considered adequately protective.

2.12 The Selected Remedy

2.12.1 Summary of the Rationale for the Selected Remedy

The selected remedy consists of continued operation of the existing dynamic groundwater collection and treatment system, implementation of institutional controls, and monitoring. The selected remedy provides for containment of the groundwater plume and some reduction in contaminant mass. This remedy is intended to be an interim remedial action. Additional information will be gathered to support a final remedy that will be targeted at remediating all or part of the plume by various means such as monitored natural attenuation, technical impracticality waivers, the establishment of compliance zones, and the implementation of new technologies to reduce or eliminate the source area contamination.

2.12.2 Description of Remedial Components

The selected interim remedial action includes the following actions:

- Continue to operate the existing groundwater recovery and treatment system at OU-1. Adjust performance by optimizing pumping and recovery well locations as necessary.
- Implement an environmental sampling program to monitor the performance of the groundwater recovery treatment system and to monitor the impacts to ecologically-sensitive areas.
- Continue to look for effective measures to reduce source area contamination in order to expedite groundwater cleanup.
- Conduct Five-Year Reviews to ensure that the remedy continues to provide adequate protection of human health and the environment.

2.12.3 Groundwater Treatment System

The groundwater remediation system at OU-1 started operating in 1991. It originally consisted of three groundwater collection trenches in the surficial aquifer and four boundary interceptor wells, screened in both the lower and bedrock aquifers. The elements of the groundwater remediation system are shown in Figure 2-2.

In recent years, the groundwater remediation system has been considered a dynamic operation with changes being made in the system elements and in the operation and pumping rates of the individual components. In 1997, two interceptor wells were installed near the contaminant source areas at Sites 1 and 2. An experimental VER system also was installed to accelerate the removal of contaminant mass from the bedrock aquifer at Site 1. In 1999, three monitoring wells associated with the Site 1 VER system were converted to conventional interceptor wells to augment the VER effort and an interceptor well was installed in the center of Burn Pit #2 at Site 1. Additional changes and additions aimed at improving the effectiveness of groundwater remediation are expected to be made in the future as suggested by operational experience and monitoring.

Groundwater Collection Trenches and Recharge Basins

Three groundwater collection trenches were installed as part of the original remediation system. The trenches were excavated well below the water table in the surficial aquifer. They were backfilled with gravel, with a perforated pipe laid along the bottom. The pipe drains to a sump, from which the extracted groundwater is pumped to the groundwater treatment facility.

The collection trenches at Sites 2 and 3 enclose areas where contaminants were released to the ground. Artificial recharge basins were constructed at the ground surface within the enclosed area as a means to discharge the treated water and to accelerate flushing of the contaminated soils above the water table. Treated effluent is piped back from the groundwater treatment plant for application to the recharge basins. However this capability for on-site recharging has been used sparingly since the end of 1991 due to iron bacteria fouling of the recharge piping and its bedding material.

The collection trenches at Site 2 and 3 were intended to recover contaminated groundwater from the surficial aquifer both inside and outside the enclosed areas. Regular groundwater monitoring over the years of trench operation has shown that they have generally performed as intended.

The collection trench at Site 1 is similar to those at Sites 2 and 3 except it is a linear trench constructed along the side of Hartwells Hill downgradient of the fire training area where contaminants were released to the ground. The pipe drains to a sump, from which the extracted groundwater is pumped to the groundwater treatment facility. The trench initially was intended to intercept the flow of contaminated groundwater from each of the three aquifers. However, due to construction difficulties, the trench was not installed as deep as intended and the silt layer that separates the surficial and lower aquifers slows the upflow from the lower and bedrock aquifers into the trench. Consequently, much of the groundwater collected by the trench comes from the surface aquifer. Regular groundwater monitoring over the years of trench operation has shown that it has had a significant positive effect on the surface aquifer but has not had much impact on the lower and bedrock aquifers.

In 1998 groundwater was pumped from the trench at Site 1 at an average of 24 gallons per minute (gpm), from the trench at Site 2 at an average of 106 gpm, and from the trench at Site 3 at an average of 77 gpm. Prior to January 1997, the trench sumps were equipped with fixed-rate pumps and the bulk of the collection came from Site 3 since it had the longest trench and largest pump. Also, the combined pumping capacity from the three sumps was

less than the treatment plant's capacity. In January 1997, the three sumps were refitted with larger pumps and in November 1997 variable-speed controls were added to each pump. These changes allow for the operation of the treatment plant at full capacity while varying the rate of collection from the sumps. This provides the capability to prioritize collection in order of the priority of the source. Priority 1 sources are Site 1 and all interceptor/recovery wells, Priority 2 is Site 2 and Priority 3 is Site 3.

Interceptor Wells

Ten interceptor wells are presently in operation at OU-1. IW-1 through IW-6 locations are shown in Figure 2-2. IW-7, 8, and 9 are in the immediate vicinity of the VER system, which is also shown in Figure 2-2 and IW-10 is in the center of Burn Pit #2 at Site 1. The first four are boundary interceptor wells with the objective of intercepting contaminated groundwater migrating offsite to the north in the lower and bedrock aquifers. These four boundary wells work together to form an elongated zone of hydraulic influence that serves as a barrier to offsite groundwater flow in both aquifers.

In August 1997, two additional interceptor wells (IW-5 and IW-6) were put into operation. IW-5 was completed in the lower aquifer at Site 2 with the objective of controlling the migration of groundwater away from an area of relatively high contaminant concentrations in the lower aquifer under the Site 2 collection trench. Interception of contaminants near their source in this area may eventually lead to shrinkage of the northern part of the contaminant plume.

Interceptor Well IW-6 was completed in the bedrock aquifer on the downgradient side of the Site 1 collection trench. This is an area of relatively high contaminant concentrations, where groundwater recovery results in the removal of considerable contaminant mass from the aquifer. Well IW-6 may also be in an area where Dense Non-Aqueous Phase Liquid (DNAPL), or free chemical product, is present in the lower and bedrock aquifers. The presence of DNAPL is suspected because of the high VOC concentrations (22,000 ppb TCE in May 1998), but DNAPL has not actually been recovered in this area, and its areal extent is unknown. DNAPL has been recovered from the area of Site 1 where the VER system and IWs 7, 8, 9, and 10 are located. It is possible that groundwater extraction from Well IW-6 could isolate the residual DNAPL source and eventually reduce the size of the solute plume. However, without detailed knowledge of the extent of DNAPL presence, this can only be determined by observing the response of the contaminant distribution to pumping from IW-6 over time.

The VER system at Site 1 in the vicinity of Burn Pit #1 and the Burn Pit #1 Runoff Area originally included monitoring wells to assess the effectiveness of the system. Following the completion of the Demonstration Project in April 1999, conventional well pumps were installed in three of the monitoring wells to increase the quantity of DNAPL and groundwater with extremely high VOC concentrations being removed at the Site 1 source area. These wells are screened in both the bedrock and overburden aquifers. Also in 1999, IW-10 was installed in the center of Burn Pit #2 at Site 1 and is screened in both the surface and lower aquifers. DNAPL has been recovered from the area of Site 1 where the VER system and IWs 7, 8, 9, and 10 are located.

Vacuum Enhanced Recovery (VER) System

In October 1997, a VER system was installed upgradient of the Site 1 collection trench in the vicinity of Burn Pit #1 and the Burn Pit #1 Runoff Area. The VOC concentrations are high in this area, and DNAPL is known to be present. The VER system consists of four extraction wells completed into the bedrock. The four wells are arranged at the corners of a square approximately 40-feet on a side. Vacuum lines connect the wells to a vacuum pump that can pump both liquids and gases. By applying a vacuum in the aquifer, these wells increase the inward flow of groundwater and accelerate flow to the wells. The liquids produced are potentially both contaminated groundwater and the non-aqueous source liquids. These are pumped to the OU-1 groundwater treatment plant. In addition, the flow of vapor to the wells removes contaminants and permits remediation to continue even when the aquifer has been substantially de-watered. The vapors recovered are routed through activated carbon units for removal of the VOCs prior to discharge to the atmosphere. These units are monitored to ensure that at least 95% of the volatile contaminants are removed. The carbon is either replaced or regenerated on-site whenever monitoring indicates that the efficiency of the carbon is approaching regulatory limits.

The VER system was originally installed as a Technology Transfer Demonstration Project. This project operated for two 6-month periods between the end of October 1997 and April 1999. This demonstration was very successful in removing contaminant mass from the bedrock. It was so successful that, following completion of the demonstration project, the system was incorporated in the existing OU-1 groundwater treatment system. Continuous recovery operations commenced 28 April 1999 and will continue as long as significant contaminant mass is being removed. The four VER wells recover liquids at a total rate of approximately 1-2 gpm.

Groundwater Treatment

All of the groundwater collected by the elements described above is pumped to a central groundwater treatment plant. The maximum flow capacity of the treatment plant is approximately 320 gallons per minute (gpm). The plant location and the approximate alignment of the system piping are shown in Figure 2-2. The groundwater is pumped through two air stripping towers to remove the volatile compounds. The water cascades through materials within the towers and contaminants are removed from the groundwater in the process and go into a gaseous phase. The water that leaves the towers, called *effluent*, is sampled and analyzed by a commercial laboratory at least monthly to ensure that it meets regulatory discharge parameters. The treated effluent can be pumped to the recharge basins at Sites 1 and 2 and/or discharged to a drainage channel between the treatment plant and the northeast-southwest runway of Hanscom Field. This drainage channel flows to the wetlands in the Bedford Town Forest. As stated above, since the end of 1991 the bulk of the treated effluent has been discharged into the drainage channel because of iron bacteria fouling the recharge basins. Between 1991 and March 2000 approximately 1 billion gallons of water was treated and discharged from the treatment plant. Approximately 88% of the treated effluent was discharged into the drainage channel.

The air that is pumped through the stripping towers is passed through two activated carbon units in series to remove the volatile contaminants in the air prior to discharge to the atmosphere. These units are monitored continuously to ensure that at least 95% of the

volatile contaminants are removed. The treatment plant also includes a steam boiler and chiller for the regeneration of the carbon units whenever monitoring indicates that the efficiency of the carbon is approaching regulatory limits.

Groundwater Monitoring

An extensive network of groundwater monitoring wells has been installed at OU-1 to define the nature and extent of contamination, to design the collection system, and to monitor the effectiveness of the remedial system. Groundwater sampling was initiated in 1986. To date, 13 rounds of sampling have been performed. Each round has included both water-level measurements in monitoring wells and the collection of groundwater samples for VOC analysis.

The number of monitoring wells included in the sampling rounds has generally increased over the years. Round 11 included water level measurements in 153 monitoring wells, 4 interceptor wells, 18 trench cleanouts, and the three trench sumps. Water quality samples were collected from 107 monitoring wells, 6 interceptor wells, and 5 surface water sampling locations. The groundwater and surface water samples were analyzed for VOCs. Selected samples were also analyzed for hardness and total and dissolved lead. The results of Sampling Round 11 and a summary of all earlier sampling rounds are presented in the Round 11 Sampling Report (H&A, 1998). Results from Rounds 12 and 13 completed in 1999 were consistent with the earlier sampling.

This remedyincludes the continuation of groundwater monitoring at OU-1, but in a reduced number of selected monitoring wells and surface water sampling locations. The monitoring wells to be included in the LTSP for this remedy were selected based upon their geographical location, aquifer, and distribution across the site. The monitoring wells for the upper, lower, and bedrock aquifers were selected from the following geographic areas of the site:

- Along the upgradient portion of the contaminant plume to monitor any potential contaminant contributions from upgradient of the OU-1 source areas (i.e. the Naval Weapons Industrial Reserve Plant);
- From within the known OU-1 source areas to assess any potential changes in contaminant concentrations in these source areas; and
- In the downgradient portion of the contaminant plume in OU-1.

The proposed LTSP for this remedy is a two-phase approach. The first phase includes annual sampling of 40 selected wells to confirm the containment of the OU-1 plumes. Analysis of these samples will be for VOCs using an off-site commercial laboratory. In addition, water levels will be collected from selected surface aquifer wells quarterly to assess the effectiveness of the collection trenches at Sites 1, 2 and 3 and from all OU-1 wells semi-annually to monitor seasonal trends. This phase of the LTSP will also include the monthly analysis of the treatment facility's influent and effluent for VOCs. This analysis is to confirm the effectiveness of the treatment process and will be conducted by an off-site commercial laboratory.

The second phase of the LTSP is the sampling of collection sources and monitoring wells for screening by the treatment system operations and maintenance (O&M) staff using an onsite

gas chromatograph (GC). The purpose of this sampling and analysis is for system optimization and to identify trends in the level of VOCs at groundwater recover points and within the OU-1 plumes. This GC analysis will only quantify the two principal contaminants of concern, TCE and cis-1,2-DCE. Source areas and wells to be sampled and the frequency of sampling will be evaluated on an on-going basis. This will be determined by the Hanscom AFB Restoration Program Manager based on changes to the system, previous results, and O&M staff availability.

The LTSP for this remedyincludes the laboratory analysis of fewer samples than Alternative G-2. However, when combined with the on-site screening, this program will provide more data to assess the overall effectiveness of the remedial effort and progress towards a permanent solution.

In addition, this remedyincludes the collection of a surface water sample from one of the sample points that has been sampled in each LTSP round (RAP1-SW4). This location will be included in the LTSP to determine whether water quality in the Wetland B/beaver pond area is being affected by contaminated groundwater migrating from the upper aquifer as well as discharge from the groundwater treatment plant to the drainage channel. The surface water sample will be analyzed for a full suite of VOCs.

To address uncertainty raised in the Ecological Risk Assessment, Alternative G-2 included plans to conduct additional sediment and surface water sampling as part of the LTSP. The same proposed sediment and surface water sampling is proposed as part of Alternative G-3. The purpose of this sampling is to determine whether sediment may be the source contributing to the elevated concentrations of lead and copper in the Wetland B/beaver pond. If it is determined that the sediment may be the source for the lead and copper contamination in the Wetland B/beaver pond, the ERA will be re-evaluated to determine whether or not sediment remedial measures are warranted.

Institutional Controls

Under the selected remedy, institutional controls will be put in place to establish adequate safeguards that control access to contaminated groundwater and soil. Institutional controls for portions of OU-1 located on Hanscom AFB property, such as the campground, will include the addition of groundwater and land use restrictions to the Base Comprehensive Land Use Plan for Hanscom AFB. These ICs will be implemented and enforced by Hanscom AFB. Hanscom AFB will have ultimate responsibility for ensuring that these controls, as a component of the selected remedy, continue to be in place and are effective and protective of human health and the environment. For those portions of OU-1 located on MASSPORT property (the majority of the site), a Memo of Understanding will be sought with MASSPORT by Hanscom AFB stating that:

- Groundwater in OU-1 cannot be used for consumptive use; and
- Excavation of soils in the three source areas will be controlled.

For those portions of OU-1 located on Town of Bedford property a Memo of Understanding will be sought with the Town of Bedford by Hanscom AFB:

- Acknowledging the groundwater contaminant plume;
- Preventing the consumptive use of groundwater; and

- Controlling (preventing) the issuance of groundwater well permits for land within OU-1.

A well inventory was performed in 1992 by M&E as part of the IRP Stage 2 Remedial Investigation. This survey revealed that the nearest active public or private well is outside of the OU-1 groundwater plume and institutional control area (greater than 3000 feet and 7000 feet, respectively, northeast of the leading edge of the OU-1 groundwater plume). This conclusion was confirmed by Hanscom AFB during a meeting with the Town of Bedford Board of Health in October 2000. Restrictions on the use of these wells is not required at this time given the significant distance of these wells from the leading edge of the OU-1 groundwater plume, and the existing network of groundwater monitoring wells that is being used to track changes in the plume.

Should the Air Force plan on transferring or leasing any property affected by OU-1, whether or not as a result of base closure, the Air Force will consult with USEPA and MADEP on the specific wording on groundwater and land use restrictions to be included in the documents evidencing the transfer or lease. If the property is transferred, or the lease allows capital improvements, a technical evaluation of the continued effectiveness and appropriateness of the remedy will be undertaken considering long-term monitoring results to date, the proposed land use, and the fact that the Air Force may no longer actively own or operate the property.

To the extent required by law, the USAF will review the site at least once every five years after the initiation of remedial action at the site if any hazardous substances, pollutants or contaminants remain at the site (above levels that allow for unlimited use and unrestricted exposure) to assure that the remedial action continues to protect human health and the environment.

2.12.4 Summary of the Estimated Remedy Costs

A table detailing the selected remedy costs is presented in Appendix C. This remedy includes the continued operation of the groundwater treatment plant in its current configuration with the potential optimization of the system as appropriate. This remedy also includes the continued implementation of a LTSP. The monitoring program includes water level measurements at 191 locations, sampling of 194 existing monitoring wells with an analytical screening by a field GC unit, sampling of 44 existing monitoring wells for offsite VOC analysis, and one surface water sample location. As mentioned above, uncertainty associated with the ecological risk evaluation will be addressed by some additional sediment and surface water sampling during the next two LTSP rounds. There is no capital cost associated with this remedy in its current configuration, because no new monitoring wells will need to be installed. The annual costs for the treatment plant and monitoring will be approximately $586,320 for the first year, and approximately $564,240 in subsequent years. Six 5-year site reviews are estimated to cost $25,000 each. The duration of the monitoring period will depend upon the actual contaminant plume migration and the site-wide remedial action plan adopted. If continued for 30 years, the total cost would be approximately $17,099,280. The present worth, based on a 5 percent discount rate, is $9,199,070. This estimate is based upon records of past operational costs.

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or in an amendment to this IROD or in the final ROD. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

2.12.5 Expected Outcomes of the Selected Remedy

The primary outcome of the selected interim remedy is that the human health risks associated with the contaminated groundwater at the site will be controlled through the use of the ICs, and that continued operation of the remediation system will draw contamination back from Bedford Town Forest and reduce the concentration of potential groundwater discharges to surface water. Surface water and groundwater sampling as part of the LTSP will confirm the effectiveness of the remedy in achieving RAOs and groundwater sampling at confirmed plume source areas as part of the LTSP will confirm that any groundwater contamination resulting from residual soil contamination remains on site. Also as previously stated two rounds of sediment and surface water sampling will be conducted to resolve the uncertainty that was raised in the ERA regards to elevated concentrations of lead and copper in the Wetland B/beaver pond.

2.12.5.1 Cleanup Levels

Interim Groundwater Cleanup Levels

Interim cleanup levels have been established in groundwater for all COCs determined to pose an unacceptable risk to either public health or the environment. These interim cleanup levels have been set based on the chemical-specific ARARs for OU-1, i.e., federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards). Table 2-10 summarizes the interim cleanup levels for carcinogenic and non-carcinogenic COCs in groundwater.

The groundwater beneath and directly downgradient to OU-1, and beneath and directly downgradient to the Hanscom AFB/Hanscom Field NPL Site as a whole, has been designated as GW-1 (i.e., as a potential future drinking water supply) under state law by means of a Town of Bedford Aquifer Protection District by-law that was enacted through a process authorized by and implementing the MCP. In addition, MADEP has classified the eastern side of OU-1, east of Runway 5-23, as an approved Zone II; under the state drinking water regulations (310 CMR 22.02), a Zone II is "that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated." Further in addition, the northeastern portion of the site at the northern end of Runway 5-23 is classified as a Potentially Productive Aquifer; the MCP defines "Potentially Productive Aquifer" in part as "all aquifers delineated by the U.S. Geological Survey (USGS) as a high or medium yield aquifer." The MADEP Site Scoring Map reflecting these areas is included as Figure 2-15.

This remedy is intended to be an interim remedial action. It will achieve action-specific ARARs for OU-1 groundwater captured by the dynamic groundwater collection and

Table 2-10

Hanscom Air Force Base

Interim Remediation Goals (RGs)

List of Detected Compounds and Corresponding MCP Method 1 Standards and EPA MCLs

Contaminants of Concern (COCs)	MCP GW-1 Standard	MCP GW-2 Standard	MCP GW-3 Standard	EPA MCLs
Organic Compounds (ug/L)				
Chloroform	5	400	10,000	see notes
Benzene	5	2,000	7,000	5
Ethylbenzene	700	30,000	4,000	700
1,1-Dichloroethane	70	9,000	50,000	NA
1,1-Dichloroethene	7	900	50,000	7
1,2-Dichloroethene (total)	100	20,000	50,000	100
Styrene	100	900	50,000	100
Tetrachloroethene	5	3,000	5,000	5
Toluene	1,000	6,000	50,000	1000
Trichloroethene	5	300	20,000	5
1,1,1-Trichloroethane	200	4,000	50,000	200
1,2,4-Trimethylbenzene	NA	NA	NA	NA
Vinyl Chloride	2	2	40,000	2
Total Xylenes	10,000	6000*	50,000	10000
Inorganic Compounds (ug/L)				
Lead	15	NA	30	15

Notes:

Shaded cells indicate which standard established the RG for the compound

* GW-2 Standard applies if contamination is found within 30 feet of an existing occupied building or structure, and the average annual depth to groundwater in that area is 15 feet or less

MCP - Massachusetts Contingency Plan (310CMR40.0000)

Method 1 Standards obtained from 310 CMR 40.0974(2) and shown in ug/l (parts per billion or ppb)

NA - Standard not available

MCL - Maximum Concentration Limit

MCL for Chloroform expressed as 0.1 mg/l Chloroform (THM); 1994 proposed rule for proposed disinfectants and disinfection by products - total for all THMs: 0.08 mg/l Chloroform (THM)

treatment system, but it will not achieve the chemical-specific ARARs within the OU-1 groundwater plume because federal and state MCLs, federal MCLGs and state MCP Method 1 GW-1 standards will not be met in the short-term. Under section 121(d)(4)(A) of CERCLA, the Regional Administrator concurs with the decision to waive attainment of compliance with these chemical-specific ARARs within the groundwater plume on the basis that this action is an interim measure and will become part of a total remedial action that will meet or attain ARARs when it is completed. Even though the chemical-specific ARARs will not be met everywhere within the existing plume footprint in the short-term, the plume is expected to be effectively contained, thus preventing further degradation.

Other Cleanup Levels

To address uncertainty raised in the Ecological Risk Assessment, the interim remedy includes plans to conduct additional sediment and surface water sampling as part of the LTSP. The purpose of this sampling is to determine whether sediment may be the source contributing to the elevated concentrations of lead and copper in the Wetland B/beaver pond. If it is determined that the sediment may the source for the lead and copper contamination in the Wetland B/beaver pond, the ERA will be re-evaluated to determine whether or not sediment remedial measures are warranted. Sediment interim cleanup levels will be consistent with the ecological risk management goals established in the OU-1 ERA.

2.13 Statutory Determinations

The selected remedy was developed by combining components of different source control and management of migration technologies to obtain a comprehensive approach for site remediation. In summary, the response action will provide protection of human health and the environment by effectively containing the continued migration of groundwater contaminants and is expected to reduce the overall extent of the groundwater plume via a reduction in the contaminant mass. The site risks associated with exposure to groundwater and soil contamination will be reduced through the implementation of institutional controls. This remedy is intended to be an interim remedial action. Additional information will be gathered to support a final remedy that will be targeted at remediating all or part of the groundwater plume. The interim action will neither be inconsistent with nor preclude implementation of the final remedy.

The remedial action selected for implementation at OU-1 is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs or invoke the appropriate waiver, and is cost effective. Because the selected remedy is an interim remedial action and does not constitute the final remedy for OU-1, it is not intended to address the statutory mandate for utilizing permanent solutions to the maximum extent practicable. It does not provide permanent aquifer restoration but rather is primarily an interim containment remedy with institutional controls to prevent exposure to contaminated media and with limited, secondary objectives of source area contaminant mass removal and plume capture and treatment. In addition, although the selected remedy uses treatment to reduce contaminant toxicity, mobility and volume, the statutory preference for remedies that employ treatment to reduce contaminant toxicity, mobility or volume will be more fully addressed by the final remedy.

2.13.1 The Selected Remedy is Protective of Human Health and the Environment

The remedy at this site will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls and institutional controls. More specifically, for groundwater, this remedy protects human health and the environment by hydraulically confining the plume of dissolved contaminants and preventing contaminant migration to potential exposure points. Continued operation of the existing remediation system will draw contamination back from Bedford Town Forest and reduce the concentration of potential groundwater discharges to surface water. In addition, the implementation of ICs will serve to control access to and exposure to the contaminated media. Monitoring groundwater within OU-1 will serve as an early warning system. Implementation of the selected remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

2.13.2 The Selected Remedy with the Interim Waiver Complies With ARARs

The selected remedy along with the interim waiver granted under CERCLA § 121 (d) (4) (A) will comply with all federal and any more stringent state ARARs that pertain to the site. Under section 121(d)(4)(A) of CERCLA, the Regional Administrator concurs with the decision to waive attainment of the following applicable or relevant and appropriate requirements (ARARs) within the groundwater plume on the basis that this action is an interim measure and will become part of a total remedial action that will meet attain ARARs when it is completed: the federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), the SDWA Maximum Contaminant Level Goals, the Massachusetts Drinking Water Standards, and the Massachusetts Contingency Plan (MCP) Method 1 GW-1 groundwater standards.

Chemicals exceeding ARARs are VOCs, primarily trichloroethylene (TCE), cis 1,2-dichloroethylene (DCE), and vinyl chloride.

ARARs for OU-1 include both federal and state requirements and are listed below, including those that have been waived, and presented in more detail in Appendix D. A discussion of why these requirements are applicable or relevant and appropriate may be found in the FFS Report in Section 2.3. Federal requirements include:

1. Safe Drinking Water Act MCLs (40 CFR 141.11-141.16) (USEPA 1999)
2. Safe Drinking Water Act MCLGs (40 CFR 141.50-141.51)
3. Fish and Wildlife Coordination Act (16 USC 661 et seq.)
4. Protection of Wetlands – Executive Order 11990 (40 CFR 6, Appendix A)
5. Federal Ambient Water Quality Criteria (AWQC), 33 U.S.C 1314(a); (40 CFR Part 122.44)
6. Protection of Floodplains, Executive Order 11988 (40 CFR 6, Appendix A)
7. National Pollutant Discharge Elimination System (NPDES) (40 CFR 122-125 and 131)
8. RCRA 40 CFR Part 264, Subpart F – Releases from Solid Waste Management Units (40 CFR 264.90 – 264.101 and 265.90 – 265.94)

9. RCRA Identification and Listing of Hazardous Wastes (40 CFR 261.24)
10. RCRA Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262)
11. RCRA Air Emission Standards for Process Vents, 40 CFR Part 264, Subpart AA & Subpart BB
12. USEPA Policy on Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-28
13. USEPA New England Region memorandum, 12 July 1989 from Louis Gitto to Merril S. Hohman

State requirements include:

1. Massachusetts Drinking Water Standards (310 CMR 22)
2. Massachusetts Contingency Plan GW-1 Standards (310 CMR 40.0974)
3. Massachusetts Wetlands Regulations (310 CMR 10.51-10.60, MGL c. 131, Section 40: Wetlands Protection Act)
4. Massachusetts Endangered Species Act, 321 CMR 10.00, (MGL c. 131A)
5. Clean Waters Act – Surface Water Discharge Permit Program (314 CMR 3.00; MGL c. 21 Sections 26-53)
6. Massachusetts Surface Water Quality Standards (314 CMR 4.05(3)(b)5-8; MGL c.21 Sections 26-53)
7. MA HWMR Groundwater Protection (310 CMR 30.660-30.679)
8. MA Standards for Analytical Data for Remedial Response Action, Bureau of Waste Site Cleanup Policy 300-89.
9. Massachusetts Groundwater Discharge Permit Program (314 CMR 5.00; MGL c.21 Sections 26-53)
10. MA HWMR, Use and Management of Containers, 310 CMR 30.689; Storage and Treatment in Tanks, 310 CMR 30.699
11. Solid Waste Disposal Laws (MGL c. 21H, MGL c. 111, 150A-150A ½, 310 CMR 19.100-151
12. Hazardous Waste disposal laws (MGL c.21C), 310 CMR 30.001-009, 30.590-593, 30.633, 30.660-666.
13. Massachusetts Air Pollution Control Regulations (310 CMR 7.09)
14. MADEP Off-gas Treatment of Point Source Remedial Air Emissions (Policy No. WSC-94-150)

2.13.3 The Selected Remedy is Cost-Effective

In the USAF's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination

was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each remedy then was compared to the remedy's costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent. Costs for Alternatives 2 and 3 are presented in Appendix C.

2.13.4 The Selected Remedy Utilizes Permanent Solutions to the Maximum Extent Practicable

Because the selected remedy is an interim remedial action and does not constitute the final remedy for OU-1, it is not intended to address the statutory mandate for utilizing permanent solutions to the maximum extent practicable. It does not provide permanent aquifer restoration but rather is primarily an interim containment remedy with institutional controls to prevent exposure to contaminated media and with limited, secondary objectives of source area contaminant mass removal and plume capture and treatment. In addition, although the selected remedy uses treatment to reduce contaminant toxicity, mobility and volume, the statutory mandate for permanence will be more fully addressed by the final remedy.

2.13.5 The Selected Remedy Satisfies the Preference for Treatment as a Principal Element

Although this interim action is not intended to address fully the statutory mandate for treatment, to the maximum extent practicable, this interim action does utilize treatment. Because this action does not constitute the final remedy for the operable unit, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principle element, although partially addressed in this remedy, will be addressed by the final response action. Subsequent actions will address fully the threats posed by conditions at this operable unit.

2.13.6 Five-Year Reviews of the Selected Remedy are Required

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

2.14 Documentation of No Significant Changes

Hanscom AFB presented an interim proposed plan, *Interim Proposed Plan for Hanscom AFB Operable Unit 1*, CH2M HILL, June 2000, discussing the selected interim remedy. The preferred alternative was continued operation of the groundwater collection and treatment system to provide for source control and management of migration through containment of the groundwater plume and some reduction in contaminant mass. Additional management of contaminants includes monitoring and institutional controls. Hanscom AFB reviewed all

written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the proposed plan, were necessary.

2.15 State Role

The MADEP has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the Remedial Investigation, Risk Assessment and Feasibility Study to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental and facility siting laws and regulations. The MADEP concurs with the selected remedy for OU-1. A copy of the declaration of concurrence is attached as Appendix E.

3.0 References

OU-1 and Hanscom AFB Specific Documents

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Appendix A – Administrative Record Index

SECTION 1: PRELIMINARY ASSESSMENTS

DOCUMENTS:

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DOCUMENTS:

No. 3: *Hydrogeologic Investigation—Final Report;* prepared by Weston Consultants; April 1983 (IRP Sites 1, 2, 3, and 5).

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Letter to the MA DEP, from Hanscom AFB Environmental Flight, regarding the Analytical Results Report for Investigation of Suspected Hazardous Waste Sites; 3 Dec 91 (IRP Sites 16, 17, 18, 19, and 20).

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Letter to MA DEP, from the Hanscom AFB Deputy Base Civil Engineer, transmittal of SOW for Site 21 SI and IRA and draft Site Investigation Report for Investigation of Suspected Hazardous Waste Sites; 11 Aug 92 (IRP Sites 16, 17, 18, 19, 20 and 21).

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No. 293-A: *Technical Work Plan for Demonstration of Vacuum-Enhanced Recovery (VER) Technology (Final)*; prepared by Geraghty & Miller, September 1997 (IRP Site 1).

No. 293-C: *Demonstration of Vacuum Enhanced Recovery Technology at Site 1, Hanscom AFB, MA (technical report);* prepared by Arcadis Geraghty & Miller, June 2000 (IRP Site 1).

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No. 54: *Construction Specifications, IRP Drum Removal Phase*; prepared by Haley & Aldrich, Inc., April 1987 (IRP Site 2).

No. 52: *IRP Drum Removal—Phase I, Chemical Quality Management Plan and Lab Protocol;* prepared by Hydro-Dredge, October 1987 (IRP Site 2).

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No. 51: *IRP Drum Removal Phase I, Pre-Construction Submittals;* prepared by Hydro-Dredge, Inc., 1987 (IRP Site 3).

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Letter to Hanscom AFB Environmental Flight, from US EPA, regarding the IRP Site 21 Quarterly Status Report; 15 Apr 96 (IRP Site 21).

SECTION 4: REMEDIAL INVESTIGATIONS

DOCUMENTS:

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No. 27: *IRP Phase IV-A—Hanscom AFB Area 1, Appendix F; Architect/Engineer's Remedial Investigation Interpretive Report;* prepared by Haley & Aldrich, Inc.; May 1988 (Area 1—IRP Sites 1, 2, 3/5, and 4).

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No. 265: *Final Sampling and Analysis Plan, OU-1;* prepared by CH2M Hill; August 1996 (Operable Unit 1).

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No. 298: *Groundwater Flow Model Report, Operable Unit 1 (Draft);* prepared by CH2M Hill; July 1997 (Operable Unit 1).

No. 250: *Final Report, Comprehensive Ecological Analysis;* prepared by LEC Environmental Consultants, Inc.; August 1997 (Basewide, 2 volumes).

No. 307: *Solute Transport Model Setup and Calibration Report, Operable Unit 1 (Draft);* prepared by CH2M Hill; December 1997 (Operable Unit 1).

No. 312: *OU-1 Field Report;* prepared by CH2M Hill; January 1998 (Operable Unit 1).

No. 305: *Work Plan, Operable Unit 1 Monitoring Well Cluster Installation (Final);* prepared by CH2M Hill; February 1998 (Operable Unit 1).

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No. 332: *OU-1 Monitoring Well Cluster Installation;* prepared by CH2M Hill; July 1998 (Operable Unit 1).

No. 335: *Innovations in Site Characterization: Case Study, Hanscom AFB OU-1 (Sites 1, 2, & 3);* prepared by the US Environmental Protection Agency; September 1998 (Operable Unit 1).

No. 343: *Technical Memorandum: Soil to Groundwater Pathway, OU-1;* prepared by CH2M Hill; December 1998; (Operable Unit 1).

No. 315: *Ecological Risk Assessment, Operable Unit 1 (Final);* prepared by CH2M Hill; January 1999 (Operable Unit 1).

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Letter to Hanscom AFB Environmental Flight, from LEC Corporation, regarding LEC's Scope of Services; 27 Feb 1995 (Basewide).

Letter to US EPA, from CH2M Hill, transmittal of the Data Usability Assessment for Hanscom AFB IRP data; 24 Aug 95 (IRP Sites 1, 2, 3, 4, 5, 6, 7, 8, 13, 19, 20, 21 & 22).

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding the EPA's comments on the Data Usability Assessment for Hanscom AFB IRP data; 27 Sep 95(IRP Sites 1, 2, 3, 4, 5, 6, 7, 8, 13, 19, 20, 21 & 22).

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Letter to Hanscom AFB Environmental Flight, from US EPA, transmittal of Comments on the Draft Final Human Health Risk Assessment Work Plan; 12 Dec 95 (OUs 1, 2, 3 & 4).

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding groundwater modeling for OU-1; 3 Jan 96 (Operable Unit 1).

Letter to US EPA, from CH2M Hill, transmittal of responses to EPA's comments on the Human Health Risk Assessment Work Plan; 11 Mar 96 (OUs 1, 2, 3 & 4).

Letter to US EPA, from CH2M Hill, minutes of the 19 Dec 95 meeting to discuss EPA comments on the Draft Ecological Risk Assessment Methodology and Draft Problem Formulation; 11 Mar 96 (OUs 1, 2, 3 & 4).

Memo for MA DEP, from Hanscom AFB Environmental Flight, regarding the Site 20 Soil Gas Survey and Hanscom AFB Storm Water Quality Testing; 22 Mar 96 (IRP Site 20 & Basewide).

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SECTION 4: REMEDIAL INVESTIGATIONS (CONT.):

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Letter to Hanscom AFB Environmental Flight, from US EPA, transmittal of Comments on the Draft Operable Unit 1 Sampling and Analysis Plan; 30 July 96 (Operable Unit 1).

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Letter to US EPA, from CH2M Hill, regarding the Draft Work Plan for Groundwater Modeling at Operable Unit 1; 13 Mar 97 (Operable Unit 1).

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding the Draft Work Plan for Groundwater Modeling at Operable Unit 1; 11 Apr 97 (Operable Unit 1).

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Letter to US EPA (copy to MA DEP), from CH2M Hill, transmittal of the Groundwater Flow Model Report for OU-1; 7 Jul 97 (Operable Unit 1).

Letter to Hanscom AFB, from US EPA, transmittal of Comments on the Draft Groundwater Flow Model Report; 12 Aug 97 (Operable Unit 1).

Letter to US EPA (copy to MA DEP), from CH2M Hill, transmittal of responses to EPA comments on the OU-1 Groundwater Flow Model Report; 5 Sep 97 (Operable Unit 1).

Letter to US EPA (copy to MA DEP), from CH2M Hill, regarding OU-1 Solute Transport Model Initial Simulations; 25 Sep 97 (Operable Unit 1).

Letter to Hanscom AFB, from US EPA, transmittal of Comments on the Preliminary Solute Transport Simulation Results for OU-1; 20 Oct 97 (Operable Unit 1).

Memorandum to M. Slechta/CH2M Hill, from J. Glass/CH2M Hill, regarding the Solute Transport Model's sensitivity to pumping rates; 27 Oct 97 (Operable Unit 1).

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding the Solute Transport Model's sensitivity to historical pumping rates; 6 Nov 97 (Operable Unit 1).

Letter to US EPA (copy to MA DEP), from CH2M Hill, transmittal of the Draft Solute Transport Model Setup and Calibration Report; 16 Dec 97 (Operable Unit 1).

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Letter to Hanscom AFB Environmental Flight, from US EPA, transmittal of Comments on the Draft Solute Transport Model Setup and Calibration Report; 4 Feb 98 (Operable Unit 1).

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding responses to Comments on the Draft Work Plan for OU-1 Monitoring Well Cluster Installation; 10 Feb 98 (Operable Unit 1).

SECTION 4: REMEDIAL INVESTIGATIONS (CONT.):

Memorandum to Hanscom AFB Environmental Flight, from CH2M Hill, regarding an update on the ecological risk assessment for Operable Unit 1; 19 Feb 98 (Operable Unit 1).

Letter to US EPA, from CH2M Hill, regarding responses to EPA Comments on the Draft Solute Transport Model Setup and Calibration Report, OU-1; 26 Feb 98 (Operable Unit 1).

Letter to US EPA (copy to MA DEP), from CH2M Hill, transmittal of corrected copies of the Final OU-1 Well Cluster Installation Work Plan; 27 Feb 98 (Operable Unit 1).

Letter to US EPA (copy to MA DEP), from CH2M Hill, transmittal of the Draft Ecological Risk Assessment for Operable Unit 1; 3 Mar 98 (Operable Unit 1).

Letter to Hanscom AFB Environmental Flight, from US EPA, transmittal of Comments on the Draft Operable Unit 1 Ecological Risk Assessment; 4 Jun 98 (Operable Unit 1).

Letter to the US EPA and the MA Department of Environmental Protection, from Hanscom AFB Environmental Flight, transmittal of the Final Report on the Comprehensive Ecological Analysis of Hanscom AFB and Report entitled Ecological Analysis Capped Landfill Area 4; 7 Oct 1998 (Basewide and Site 4).

Letter to Hanscom AFB Environmental Flight, from US EPA, transmittal of EPA Comments on the Draft Final Risk Assessment for OU-1; 30 Nov 98 (Operable Unit 1).

Memorandum to M. Slechta/CH2M Hill, from J. Glass/CH2M Hill, regarding Verification of the Hanscom AFB OU-1 Groundwater Flow Model Against Round 11 Monitoring Data; 2 Dec 98 (Operable Unit 1).

Memorandum to US EPA and MA DEP, from CH2M Hill, transmittal of the following documents for review: 1) Meeting agenda for 11 Dec 98; 2) Verification of the Hanscom AFB OU-1 Groundwater Flow Model Against Round 11 Monitoring Data ; and 3) Soil to Groundwater Pathway Evaluation, OU-1, Hanscom AFB; 3 Dec 98 (Operable Unit 1).

Email to Hanscom AFB Environmental Flight, from CH2M Hill, regarding responses to EPA comments on the Hanscom AFB OU-1 Ecological Risk Assessment; 7 Jan 1999 (Operable Unit 1).

Letter to Hanscom AFB Environmental Flight, from the US EPA, regarding the EPA's concurrence with the Final OU-1 Ecological Risk Assessment; 11 Jan 1999 (Operable Unit 1).

Letter to AFCEE/ERD, from MA DEP, regarding the Final Ecological Risk Assessment of OU-1; 20 Jan 99 (Operable Unit 1).

SECTION 5: FEASIBILITY STUDIES

DOCUMENTS:

No. 364: *Final—Focused Feasibility Study, OU-1*; prepared by CH2M Hill; May 2000 (Operable Unit 1).

CORRESPONDENCE:

Letter to US EPA from CH2M Hill, transmittal of the OU-1 Draft Focused Feasibility Study, 29 Apr 99 (Operable Unit 1).

Letter to MA DEP from CH2M Hill, transmittal of the OU-1 Draft Focused Feasibility Study, 29 Apr 99 (Operable Unit 1).

SECTION 5: FEASIBILITY STUDIES (CONT.):

Letter to Hanscom AFB Environmental Flight, from US EPA, transmittal of Comments on the OU-1 Draft Focused Feasibility Study; 17 Jun 99 (Operable Unit 1).

Letter to US EPA (copy to MA DEP), from CH2M Hill, transmittal of responses to EPA's comments on the OU-1 Draft Focused Feasibility Study; 15 Jul 99 (Operable Unit 1).

Letter to US EPA (copy to MA DEP), from CH2M Hill,), transmittal of Draft OU-1 Focused Feasibility Study and responses to EPA's Comments of earlier draft; 11 Apr 00 (Operable Unit 1).

Letter of transmittal to Hanscom AFB Environmental Flight (copy to US EPA and MA DEP), from CH2M Hill, transmittal of Table 2-1 of the OU-1 Draft Focused Feasibility Study; 19 Apr 00 (Operable Unit 1).

Letter to Hanscom AFB Environmental Flight, from US EPA,), transmittal of Comments on the Draft Final Focused Feasibility Study for OU-1; 11 May 00 (Operable Unit 1).

Email to CH2M Hill, US EPA, and MA DEP, from Hanscom AFB Environmental Flight, transmittal of Hanscom's comments to the OU-1 Focused Feasibility Study; 12 May 00 (Operable Unit 1).

Letter to US EPA (copy to MA DEP), from CH2M Hill,), transmittal of the Final OU-1 Focused Feasibility Study, 31 May 00 (Operable Unit 1).

Letter to US EPA from CH2M Hill (copy to MA DEP), transmittal of ARAR Tables for the Final OU-1 Focused Feasibility Study, 1 Jun 00 (Operable Unit 1).

SECTION 6: PROPOSED PLANS

DOCUMENTS:

No. 5: *Recommendations & Cost Estimates for Development of Remedial Action Plans at Hanscom AFB;* prepared by Dynamac Corporation; May 1985 (Basewide).

No. 28: *IRP Phase IV-A—Hanscom AFB Area 1, Intro to Remedial Action Plans;* prepared by Haley & Aldrich, Inc.; May 1988 (Area 1).

No. 29: *IRP Phase IV-A—Hanscom AFB Area 1, Remedial Action Plan, Site 1*; prepared by Haley & Aldrich, Inc.; May 1988 (IRP Site 1).

No. 30: *IRP Phase IV-A—Hanscom AFB Area 1, Remedial Action Plan, Site 2;* prepared by Haley & Aldrich, Inc.; May 1988 (IRP Site 2).

No. 31: *IRP Phase IV-A—Hanscom AFB Area 1, Remedial Action Plan, Site 3/5*; prepared by Haley & Aldrich, Inc.; May 1988 (IRP Site 3/5).

No. 33: *IRP Phase IV-A—Hanscom AFB Area 1Environmental Assessment;* prepared by Haley & Aldrich, Inc.; May 1988 (Area 1—IRP Sites 1, 2, 3/5, and 4).

No. 365: *Interim Proposed Plan for OU-1;* prepared by CH2M Hill; June 2000 (Operable Unit 1).

No. 383: *Operable Unit 1 Interim Proposed Plan—Public Hearing Transcript;* prepared by G&M Hoey Court Reporters, 28 Jun 00 (Operable Unit 1).

SECTION 6: PROPOSED PLANS (CONT.):

CORRESPONDENCE:

Letter to US EPA, from Deputy Base Civil Engineer, transmittal of minutes of the Remedial Action Plans Meeting; 3 Apr 86; (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to US EPA, from the Hanscom AFB Deputy Base Civil Engineer, regarding delays in the IRP Phase IV contract; 9 May 86 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Conference notes on 21 May Remedial Action Plan conference at Haley and Aldrich, Inc.; 21 May 86; (Area 1—IRP Sites 1, 2, 3/5, and 4).

Conference notes on 19 Jun Remedial Action Plan conference at Haley and Aldrich, Inc.; 19 Jun 86; (Area 1—IRP Sites 1, 2, 3/5, and 4).

Conference notes on 29 & 30 Jul Remedial Action Plan conference at Haley and Aldrich, Inc.; 29 & 30 Jul 86; (Area 1—IRP Sites 1, 2, 3/5, and 4).

Conference notes on 14 & 15 Oct Remedial Action Plan conference at Haley and Aldrich, Inc.; 14 & 15 Oct 86; (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to HQ USAF/LEEVP, from HQ AF Systems Command, regarding a request for expedited AFIRM Committee Review of the RAP's for Area 1; 30 Oct 86 (IRP Sites 1, 2, 3/5, and 4).

Letter to Hanscom AFB Base Commander, from MA DEQE, regarding the Hanscom Field Notice of Responsibility; 31 Oct 86 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to Massport, from MA DEQE, regarding the Hanscom Field Notice of Responsibility; 31 Oct 86 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to Hanscom AFB Base Commander, from MA DEQE, regarding the Hanscom Field Remedial Action Plans; 31 Oct 86 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to Hanscom AFB Environmental Flight, from HQ AF Systems Command, Environmental Planning Division, regarding preparation of the final design contract for Stage 1; 7 Nov 86 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Conference notes on 24 & 25 Nov Remedial Action Plan conference at Haley and Aldrich, Inc.; 24 & 25 Nov 86; (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to Hanscom AFB Base Commander, from the Massachusetts Department of Environmental Quality Engineering, regarding Remedial Action Plans for four IRP Sites; 9 Jan 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter of Transmittal to distribution list, from Haley & Aldrich, transmittal of conference notes for 14 Jan conference; 5 Feb 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to HQ AFSC/DEV, from HQ USAF, regarding review of the Hanscom RAP for Area 1; 6 Feb 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to US ACE, from HQ AFSC, regarding IRP Area 1; 24 Feb 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to Hanscom AFB Environmental Flight, from HQ AFSC/DEV, transmittal of Environmental Assessment Certificate; 15 Jun 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

SECTION 6: PROPOSED PLANS (CONT.):

Letter to US EPA, from Hanscom AFB Environmental Flight, transmittal of Area 1 Remedial Action Plans and Environmental Assessment; 15 Jun 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to MA DEQE, from Hanscom AFB Environmental Flight, transmittal of Area 1 Remedial Action Plans and Environmental Assessment; 15 Jun 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to US ACE et al., from Engineering-Science, transmittal of Area 1 Environmental Assessment and Finding of No Significant Impact (FONSI); 15 Jun 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to regulators and other stakeholders, from Hanscom AFB Base Commander, regarding the status of Remedial Action Plans and announcing Public Information Meeting on 30 Jun 87; 22 Jun 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to Hanscom AFB Base Civil Engineer, from US ACE, regarding RAP's for Sites 1, 2, 3/5, and 4; 23 Jun 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Notes on 30 June conference held at EPA in Boston to discuss Hanscom's Drum Removal Project and RAP's; 1 Jul 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to Hanscom AFB Base Civil Engineer, from US EPA, regarding review of the RAP; 16 Jul 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to HAFB Base Commander, from MA Department of Environmental Quality Engineering, regarding comments by the DEQE on remedial action plans at Hanscom Field; 26 Aug 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Compilation of comments on the Area 1 Remedial Action Plan (RAP) and Environmental Assessment; various 1987 dates (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to US EPA (copy to MA DEP), from CH2M Hill, submittal of the OU-1 Draft Proposed Plan, 21 Apr 00 (Operable Unit 1).

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding the OU-1 Draft Proposed Plan; 30 May 00 (Operable Unit 1).

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding the OU-1 and OU-3/IRP Site 6 EPA Concurrence Dates; 6 Jun 00 (Operable Unit 1; and OU-3/IRP Site 6).

Letter to US EPA (copy to MA DEP), from CH2M Hill, submittal of Hanscom AFB OU-1 Proposed Plan and Fact Sheet; 7 Jun 00 (Operable Unit 1).

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding the OU-1 Final Proposed Plan; 8 Jun 00 (Operable Unit 1).

SECTION 7: RECORDS OF DECISION

DOCUMENTS:

No. 35: *Decision Document—Area 1 (Sites 1–5);* prepared by Hanscom AFB, April 1988 (Area 1—IRP Sites 1, 2, 3/5, and 4).

No. 103: *Decision Document—No Further Action*; prepared by Haley & Aldrich, Inc., October 1991 (IRP Site 5).

No. 126: *Decision Document (No Further Response Action Planned);* prepared by Hanscom AFB; April 1992 (IRP Sites 1, 2, and 3).

No. 194: *Draft No Further Response Action Planned Decision Document for Site 20*; prepared by EA Engineering, Science, and Technology, September 1994 (IRP Site 20).

CORRESPONDENCE:

Letter to US EPA, from Hanscom AFB Environmental Flight, transmittal of draft Site 5 Decision Documents; 17 Jul 91 (IRP Site 5).

Letter to MA DEP, from Hanscom AFB Environmental Flight, transmittal of draft Site 5 Decision Documents; 22 Jul 91 (IRP Site 5).

Letter to MA DEP, from the Hanscom AFB Deputy Base Civil Engineer, transmittal of the Decision Document for IRP Site 5 for review; 7 Nov 91 (IRP Site 5).

Letter to US EPA, from Hanscom AFB Deputy Base Civil Engineer, transmittal of the Decision Document for IRP Site 5 for review; 7 Nov 91 (IRP Site 5).

Letter to MA DEP, from Hanscom AFB Base Civil Engineer, requesting review of the Decision Document for No Further Action Planned for Sites 1, 2, and 3; 8 May 92 (IRP Sites 1, 2, and 3).

Letter to US EPA, from Hanscom AFB Base Civil Engineer, requesting review of the Decision Document for No Further Action Planned for Sites 1, 2, and 3; 8 May 92 (IRP Sites 1, 2, and 3).

Letter to MA DEP, from Hanscom AFB Environmental Flight, requesting review of No Further Action Planned Decision Documents for Sites 16, 19, and 20; 14 Jun 94; (IRP Sites 16, 19, and 20).

Letter to US EPA, from Hanscom AFB Environmental Flight, requesting review of No Further Action Planned Decision Documents for Sites 16, 19, and 20; 14 Jun 94; (IRP Sites 16, 19, and 20).

SECTION 8: POST RECORD OF DECISION

DOCUMENTS:

OU-1 Long Term Monitoring Documents:

No. 78: *Long Term Monitoring Program—Quality Control and Sampling Plan*; prepared by Haley & Aldrich, Inc., September 1990 (Area 1—IRP Sites 1, 2, 3/5, and 4).

No. 98: *Long Term Monitoring Report—Round 4*; prepared by Haley & Aldrich, Inc., November 1990 (Operable Unit 1).

No. 99: *Long Term Monitoring Report—Round 4 Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., November 1990 (Operable Unit 1).(LOST)

SECTION 8: POST RECORD OF DECISION (CONT.):

No. 100: *Long Term Monitoring Report—Round 5;* prepared by Haley & Aldrich, Inc., March 1991 (Operable Unit 1).

No. 101: *Long Term Monitoring Report—Round 5 Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., March 1991 (Operable Unit 1).

No. 108: *Long Term Monitoring—Rounds 4, 5, & 6 Daily Quality Control Reports*; prepared by Haley & Aldrich, Inc., August 1991 (Operable Unit 1).

No. 118: *Long Term Monitoring Report—Round 6*; prepared by Haley & Aldrich, Inc., February 1992 (Operable Unit 1).

No. 119: *Long Term Monitoring Report—Round 6 Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., February 1992 (Operable Unit 1).

No. 191: *Chemical Data Acquisition Plan for Long Term Monitoring;* prepared by Haley & Aldrich, Inc., December 1993 (Operable Unit 1).

No. 190: *Site Safety and Health Plan for Long Term Monitoring*; prepared by Haley & Aldrich, Inc., February 1994 (Operable Unit 1).

No. 189: *Long Term Monitoring Report—Round 6 Revised*; prepared by Haley & Aldrich, Inc., June 1994 (Operable Unit 1).

No. 221: *Long Term Monitoring Report—Round 7—Field Investigation Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1).

No. 226: *Long Term Monitoring Report—Round 7—Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1).

No. 237: *Long Term Monitoring Report—Round 7—Analytical Results Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1).

No. 238: *Long Term Monitoring Report—Round 8—Field Investigation Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1).

No. 239: *Long Term Monitoring Report—Round 8—Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1).

No. 240: *Long Term Monitoring Report—Round 8—Analytical Results Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1).

No. 255: *Chemical Data Acquisition Plan—Long Term Sampling Program;* prepared by Haley & Aldrich, Inc.; April 1996 (Operable Unit 1).

No. 272: *Long Term Monitoring Report—Round 9—Field Investigation Report (2 volumes)*; prepared by Haley & Aldrich, Inc., January 1997 (Operable Unit 1).

No. 283: *Long Term Monitoring Report—Round 9—Analytical Results Report*; prepared by Haley & Aldrich, Inc., January 1997 (Operable Unit 1).

No. 284: *Long Term Monitoring Report—Round 9—Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., January 1997 (Operable Unit 1).

SECTION 8: POST RECORD OF DECISION (CONT.):

No. 295-A: *Long Term Monitoring Report—Round 10—Field Investigation Report*; prepared by Haley & Aldrich, Inc., August 1997 (Operable Unit 1).

No. 295-B: *Long Term Monitoring Report—Round 10—Analytical Results Report*; prepared by Haley & Aldrich, Inc., August 1997 (Operable Unit 1).

No. 296: *Long Term Monitoring Report—Round 10—Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., August 1997 (Operable Unit 1).

No. 385: *Technical Memorandum—Monitoring Well Network Evaluation*; prepared by Federal Facilities Superfund Section, 1 Oct 97 (Operable Unit 1).

No. 339: *Long Term Monitoring Report—Round 11—Analytical Results Report*; prepared by Haley & Aldrich, Inc., August 1998 (Operable Unit 1).

No. 340: *Long Term Monitoring Report—Round 11—Quality Control Summary Report*; ; prepared by Haley & Aldrich, Inc., August 1998 (Operable Unit 1).

No. 338: *Long Term Monitoring Report—Round 11—Field Investigation Report*; prepared by Haley & Aldrich, Inc., September 1998 (Operable Unit 1).

No. 386: *Sampling of Volatile Organic Compounds in Groundwater by Diffusion Samplers and a Low-Flow Method, and Collection of Borehole-Flowmeter Data at Hanscom AFB*; prepared by USGS, 2000 (Operable Unit 1).

No. 345: *Final—Operation, Maintenance, and Monitoring of OU-1 and Maintenance of LF04 Quality Program Plan*; prepared by IT Corporation, March 2000 (Operable Unit One and Operable Unit 2/IRP Site 4).

No. 369: *Analytical Data Package Report for Long Term Monitoring of Operable Unit 1*; prepared by IT Corporation; April 2000 (Operable Unit 1).

Operable Unit 1 Groundwater Collection, Treatment and Recharge System:

No. 58: *Subsurface Investigation and Recommendations for Groundwater Treatment Facility*; prepared by Haley & Aldrich, Inc.; December 1987 (Operable Unit 1).

No. 59: *Air Stripping Column Design Report;* prepared by Engineering Science, Inc., December 1987 (Operable Unit 1).

No. 60: *Groundwater Treatment Facility Comparison of Vapor Off-Gas Treatment Technologies*; prepared by Engineering Science, Inc., January 1988 (Operable Unit 1).

No. 37: *Design Analysis Report, Stage II Groundwater Treatment, Volume 1 of 2;* prepared by Haley & Aldrich, Inc., June 1988 (Operable Unit 1).

No. 38: *Design Analysis Report, Stage II Groundwater Treatment, Volume 2 of 2;* prepared by Haley & Aldrich, Inc., June 1988 (Operable Unit 1).

No. 53: *Construction Specifications, Groundwater Treatment Facility—Stage II;* prepared by Haley & Aldrich, Inc., June 1988 (Operable Unit 1).

SECTION 8: POST RECORD OF DECISION (CONT.):

No. 49: *IRP Phase IV-B—Recovered Groundwater Treatment System O&M Manual*; prepared by Haley & Aldrich, Inc.; April 1990 (Operable Unit 1).

No. 77: *Operation & Maintenance of Groundwater Treatment System—Conceptual Operation & Maintenance Specification Outline*; prepared by Haley & Aldrich, Inc., May 1990 (Operable Unit 1).

No. 82: *Operation & Maintenance of Groundwater Treatment System—Prefinal Operation & Maintenance Specifications;* prepared by Haley & Aldrich, Inc., June 1990 (Operable Unit 1).

No. 84: *Operation & Maintenance of Groundwater Treatment System—Engineer's Estimate and Proposed Staffing*; prepared by Haley & Aldrich, Inc., June 1990 (Operable Unit 1).

No. 260: *Report on Bedrock Pump Test Review*; prepared by Haley & Aldrich, Inc.; June 1990 (Operable Unit 1).

No. 83: *Operations and Maintenance of Groundwater Treatment System—Final Engineers' Estimate;* prepared by Haley & Aldrich, September 1990 (Operable Unit 1). (LOST)

No. 112: *Specifications—Operation & Maintenance of Groundwater Treatment Facility;* prepared by the Army Corps Of Engineers—Omaha and Haley & Aldrich, Inc., September 1990 (Operable Unit 1).

No. 86: *Operation & Maintenance of Groundwater Treatment System—Revised Final Engineer's Estimate*; prepared by Haley & Aldrich, Inc., October 1990 (Operable Unit 1)

No. 97: *Proposal for Operation & Maintenance of Groundwater Treatment Facility—Volumes 1, 2, & 3, and Supplemental Information/Best & Final Offer*; prepared by Metcalf & Eddy, Inc., October 1990 (Operable Unit 1).

No. 120: *Remediation of Iron Bacteria Condition at Groundwater Treatment Facility*; prepared by Haley & Aldrich, Inc., January 1992 (Operable Unit 1).

No. 202: *Specifications for Chemical Cleaning Contract (Iron Bacteria Study);* prepared by Haley & Aldrich, Inc., July 1992 (Operable Unit 1).

No. 156: *Engineering Audit Report, Groundwater Treatment Facility (Iron Bacteria Study);* prepared by The Water Tech. Group, March 1993 (Operable Unit 1).

No. 176: *DE Plant and Analytical Testing Interpretation (Iron Bacteria Study);* prepared by The Water Tech. Group, November 1993 (Operable Unit 1).

No. 206: *IRP Phase IV-B—Recovered Groundwater Treatment System Operations & Management Manual—Revised*; prepared by Professional Services Group, Inc., June 1998 (Operable Unit 1).

No. 345: *Operation, Maintenance, and Monitoring of OU-1 and Maintenance of LF04 Quality Program Plan*; prepared by IT Corporation, March 00 (Operable Unit 1 and Operable Unit 2/IRP Site 4).

No. 362-1: *Demonstration Plan & Work Plan for In-Situ Substrate Addition to Create Reactive Zones for Treatment of Chlorinated Aliphatic Hydrocarbons (Final)*; prepared by Arcadis Geraghty & Miller; March 2000 (Operable Unit 1).

SECTION 8: POST RECORD OF DECISION (CONT.):

No. 362-2: *Demonstration/Work Plan Comment Responses*; prepared by Arcadis Geraghty & Miller; March 2000 (Operable Unit 1).

No. 363: *Health & Safety Plan: In-Situ Reductive Dechlorination Technology Demonstration;* prepared by Arcadis Geraghty & Miller; March 2000 (Operable Unit 1).

Operable Unit 1 Groundwater Collection, Treatment and Recharge System - Operational Reports:

No. 75: *Start-up Phase Reports for Groundwater Treatment Facility Serving OU-1*; prepared by various authors, September 1990 – January 1991 (Operable Unit 1).

No. 285: *Monthly Discharge Monitoring Reports, 1991-1998*; prepared by Metcalf & Eddy, Inc.; monthly (Operable Unit 1).

No. 354: *Monthly Operation & Discharge Monitoring Reports, 1999;* prepared by IT Corporation, (Operable Unit 1).

No. 368: *Monthly Operation and Discharge Monitoring Reports, 2000*; prepared by IT Corporation, monthly (Operable Unit 1)

OU-1 Groundwater Treatment Plant Toxicity Reports

No. 121: *Toxicological Evaluation of Treated Effluent, 9 & 11 October 1991 Samples*; prepared by EnviroSystems, Inc., October 1991 (Operable Unit 1).

No. 123: *Toxicity Evaluation of Treated Effluent, December 1991 Samples*; prepared by Springborn Laboratories, December 1991 (Operable Unit 1).

No. 122: *Toxicity Evaluation of Treated Effluent, December 1991 Samples*; prepared by Springborn Laboratories, January 1992 (Operable Unit 1).

No. 124: *Toxicity Evaluation of Treated Effluent, February 1992 Samples*; prepared by Springborn Laboratories, February 1992 (Operable Unit 1).

No. 139: *Toxicity Evaluation of Treated Effluent, May 1992 Samples*; prepared by Springborn Laboratories, May 1992 (Operable Unit 1).

No. 146: *Toxicity Evaluation of Treated Effluent, September 1992 Samples*; prepared by Springborn Laboratories, October 1992 (Operable Unit 1).

No. 147: *Toxicity Evaluation of Treated Effluent, November 1992 Samples*; prepared by Springborn Laboratories, December 1992 (Operable Unit 1).

No. 161: *Toxicity Evaluation of Treated Effluent, February 1993 Samples*; prepared by Springborn Laboratories, March 1993 (Operable Unit 1).

No. 171: *Toxicity Evaluation of Treated Effluent, May 1993 Samples*; prepared by Springborn Laboratories, June 1993 (Operable Unit 1).

No. 172: *Toxicity Evaluation of Treated Effluent, August 1993 Samples*; prepared by Springborn Laboratories, September 1993 (Operable Unit 1).

No. 173: *Toxicity Evaluation of Treated Effluent, November 1993 Samples*; prepared by Springborn Laboratories, December 1993 (Operable Unit 1).

SECTION 8: POST RECORD OF DECISION (CONT.):

No. 179: *Toxicity Evaluation of Treated Effluent, February 1994 Samples*; prepared by Springborn Laboratories, March 1994 (Operable Unit 1).

No. 192: *Toxicity Evaluation of Treated Effluent, May 1994 Samples*; prepared by Springborn Laboratories, June 1994 (Operable Unit 1).

No. 200: *Toxicity Evaluation of Treated Effluent, August 1994 Samples*; prepared by Springborn Laboratories, August 1994 (Operable Unit 1).

No. 212: *Toxicity Evaluation of Treated Effluent, November 1994 Samples*; prepared by Springborn Laboratories, December 1994 (Operable Unit 1).

No. 227: *Toxicity Evaluation of Treated Effluent, February 1995 Samples*; prepared by Springborn Laboratories, March 1995 (Operable Unit 1).

No. 244: *Toxicity Evaluation of Treated Effluent, May 1995 Samples*; prepared by Springborn Laboratories, July 1995 (Operable Unit 1).

No. 247: *Toxicity Evaluation of Treated Effluent, August 1995 Samples*; prepared by Springborn Laboratories, October 1995 (Operable Unit 1).

No. 252: *Toxicity Evaluation of Treated Effluent, November 1995 Samples*; prepared by Springborn Laboratories, December 1995 (Operable Unit 1).

No. 261: *Toxicity Evaluation of Treated Effluent, February 1996 Samples*; prepared by Springborn Laboratories, March 1996 (Operable Unit 1).

No. 266: *Toxicity Evaluation of Treated Effluent, June 1996 Samples*; prepared by EnviroSystems, Inc., June 1996 (Operable Unit 1).

No. 271: *Toxicity Evaluation of Treated Effluent, August 1996 Samples*; prepared by EnviroSystems, Inc., August 1996 (Operable Unit 1).

No. 276: *Toxicity Evaluation of Treated Effluent, January 1997 Samples*; prepared by EnviroSystems, Inc., January 1997 (Operable Unit 1).

No. 289: *Toxicity Evaluation of Treated Effluent, March 1997 Samples*; prepared by EnviroSystems, Inc., March 1997 (Operable Unit 1).

No. 292: *Toxicity Evaluation of Treated Effluent, May 1997 Samples*; prepared by EnviroSystems, Inc., May 1997 (Operable Unit 1).

No. 301: *Toxicity Evaluation of Treated Effluent, September 1997 Samples*; prepared by EnviroSystems, Inc., September 1997 (Operable Unit 1).

No. 303: *Toxicity Evaluation of Treated Effluent, November 1997 Samples;* prepared by EnviroSystems, Inc., November 1997 (Operable Unit 1).

No. 316: *Toxicity Evaluation of Treated Effluent, March 1998 Samples;* prepared by EnviroSystems, Inc., March 1998 (Operable Unit 1).

No. 336: *Toxicity Evaluation of Treated Effluent, July 1998 Samples*; prepared by EnviroSystems, Inc., July 1998 (Operable Unit 1).

SECTION 8: POST RECORD OF DECISION (CONT.):

No. 337: *Toxicity Evaluation of Treated Effluent, August 1998 Samples*; prepared by EnviroSystems, Inc., August 1998 (Operable Unit 1).

No. 342: *Toxicity Evaluation of Treated Effluent, November 1998 Samples*; prepared by EnviroSystems, Inc., November 1998 (Operable Unit 1).

No. 351: *Acute & Chronic Toxicity Test Report, March 99 Samples*; prepared by Severn Trent Laboratories, March 99 (Operable Unit 1).

No. 358: *Acute & Chronic Toxicity Test Report, June 1999 Samples;* prepared by Severn Trent Laboratories, July 1999 (Operable Unit 1).

No. 359: *Acute & Chronic Toxicity Test Report, September 1999 Samples;* prepared by Severn Trent Laboratories, September 1999 (Operable Unit 1).

No. 361: *Acute & Chronic Toxicity Test Report, December 1999 Samples*; prepared by Severn Trent Laboratories, December 1999 (Operable Unit 1).

No. 374: *Toxicity Evaluation of Treated Effluent, February 2000 Samples*; prepared by EnviroSystems, Inc., February 2000 (Operable Unit 1).

No. 377: *Toxicity Evaluation of Treated Effluent, May 2000 Samples*; prepared by EnviroSystems, Inc., May 2000 (Operable Unit 1).

CORRESPONDENCE:

Operable Unit 1—Long-Term Monitoring:

Letter to US Army Corps of Engineers, from Haley & Aldrich, Inc., regarding the Long Term Monitoring Program for Area 1; 18 Dec 89.

Letter to US EPA, from Hanscom AFB Environmental Flight, regarding Long Term Monitoring at IRP Sites 1, 2, and 3; 12 Jan 90.

Letter to the MA Department of Environmental Protection, from the Hanscom AFB Base Civil Engineer, regarding contracting of Long Term Monitoring at IRP Sites 1, 2, and 3; 16 Jan 90.

Letter to US EPA, from Hanscom AFB Environmental Flight, transmittal of Long Term Sampling Program documents for OU-1; 17 Jul 91.

Letter to MA DEP, from Hanscom AFB Environmental Flight, transmittal of Long Term Sampling Program documents for OU-1; 22 Jul 91 (IRP Site 21; Operable Unit 1).

Letter to US EPA, from Hanscom AFB Deputy Base Civil Engineer, transmittal of Long Term Sampling Program documents for OU-1; 7 Nov 91.

Letter to MA DEP, from Hanscom AFB Deputy Base Civil Engineer, transmittal of Long Term Sampling Program documents for OU-1; 7 Nov 91.

Letter to MA DEP, from Hanscom AFB Base Civil Engineer, transmittal of Long Term Sampling Program documents for OU-1; 3 Jan 92.

SECTION 8: POST RECORD OF DECISION (CONT.):

Letter to US EPA, from Hanscom AFB Base Civil Engineer, transmittal of Long Term Sampling Program documents for OU-1; 3 Jan 92.

Letter to MA DEP, from Hanscom AFB Environmental Flight, transmittal of Long Term Sampling Program documents for OU-1; 27 Mar 92.

Letter to US EPA, from Hanscom AFB Environmental Flight, transmittal of Long Term Sampling Program documents for OU-1; 27 Mar 92.

Letter to Hanscom AFB Environmental Flight, from MA DEP, regarding Long Term Sampling of IRP Sites 1, 2, and 3; 11 Jun 92.

Letter to MA DEP, from Hanscom AFB Base Civil Engineer, transmittal of the Site Safety and Health Plan and the Chemical Data Acquisition Plan for Long Term Sampling Program; 16 Jun 94.

Letter to US EPA, from Hanscom AFB Base Civil Engineer, transmittal of the Site Safety and Health Plan and the Chemical Data Acquisition Plan for Long Term Sampling Program; 16 Jun 94.

Letter to MA DEP, from Hanscom AFB Base Civil Engineer, transmittal of the Revised A-E Report Sampling Round Number 6; 16 Jun 94.

Letter to US EPA, from the Hanscom AFB Base Civil Engineer, transmittal of the Revised A-E Report Sampling Round Number 6; 16 Jun 94.

Letter to US EPA, from Haley & Aldrich Inc., transmittal of Draft Architect-Engineer Field Investigation Report for the Long Term Sampling Program; 7 Mar 95.

Letter to MA DEP, from Haley & Aldrich Inc., transmittal of Draft Architect-Engineer Field Investigation Report for the Long Term Sampling Program; 7 Mar 95.

Letter to US EPA, from Haley & Aldrich, Inc., transmittal of Long Term Sampling Program Documents, 13 Mar 95.

Letter to MA DEP, from Haley & Aldrich, Inc., transmittal of Long Term Sampling Program Documents, 13 Mar 95.

Letter to AFCEE (copies to US EPA and MA DEP), from IT Corporation, regarding the Draft Field Sampling Plan for OU-1; 5 Apr 99.

Letter to Hanscom AFB Environmental Flight, from the US Environmental Protection Agency, regarding OU-1 Draft Field Sampling Plan; 29 Apr 99.

Letter to US EPA and MA DEP, from Hanscom AFB Environmental Flight, regarding OU-1 Draft Field Sampling Plan; 1 Jun 99.

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding the OU-1 Sampling Round 11 Report, 17 Jun 99.

Letter to AFCEE/ERD (copies to US EPA and MA DEP), from IT Corporation, regarding the OU-1 Final Field Sampling Plan and the Final Health and Safety Plan; 31 Mar 00.

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding the Analytical Data Package Report for Long Term Monitoring of OU-1; 23 May 00.

SECTION 8: POST RECORD OF DECISION (CONT.):

Letter to US EPA and MA DEP, from Hanscom AFB Environmental Flight, regarding 1999 OU-1 Groundwater Sampling; 31 Jul 00.

Operable Unit 1 Groundwater Treatment System

Letter to MassPort, from Rizzo Associates, regarding design of the OU-1 Groundwater Treatment System; 25 Feb 88.

Letter to US EPA, from Hanscom AFB Deputy Base Civil Engineer, regarding final design submittal for the Groundwater Treatment System; 22 Mar 88.

Letter to MA DEQE, from Hanscom AFB Deputy Base Civil Engineer, regarding final design submittal for the Groundwater Treatment System; 22 Mar 88.

Letter to US ACE, from Haley & Aldrich, regarding a briefing meeting concerning the Groundwater Treatment Facility; 5 Apr 88.

Letter to US EPA, from Hanscom AFB Base Civil Engineer, regarding design documents for the Groundwater Treatment System; 8 Apr 88.

Letter to MA DEQE, from Hanscom AFB Base Civil Engineer, regarding design documents for the Groundwater Treatment System; 8 Apr 88.

Letter to US ACE, from Haley & Aldrich, regarding EPA briefing meeting notes (Groundwater Treatment Facility); 27 Apr 88.

Letter to US EPA, from the Hanscom AFB Base Commander, regarding Surface Water NPDES Permit; 4 May 88.

Letter to the MA Department of Environmental Quality Engineering, from the Hanscom AFB Base Commander, regarding a DEQE Groundwater Discharge Permit and Surface Water NPDES Permit; 4 May 88.

Letter to the MA Department of Environmental Quality Engineering, from the Hanscom AFB Base Commander, regarding application for an Air Discharge Permit; 4 May 88.

Letter to Hanscom AFB Environmental Flight, from GEI, comments made on behalf of the town of Bedford concerning the design of Groundwater Treatment System; 5 May 88.

Letter to Hanscom AFB Environmental Flight, from Rizzo Associates, regarding review of 90 percent design of Groundwater Treatment System by Rizzo Associates and Massport; 5 May 88.

Letter to the Hanscom AFB Base Commander, from the MA DEQE, regarding applications for permits; 3 Jun 88.

Letter to MA DEQE, from the Hanscom AFB Base Civil Engineer, regarding the Hanscom AFB air discharge permit; 20 Jun 88.

Letter to US ACE, from Haley & Aldrich, Inc., regarding Stage II—Groundwater Treatment; 6 Jul 88.

Letter to the MA DEQE, from Hanscom AFB Environmental Flight, regarding the Hanscom AFB Area 1 Remedial Investigation Report and the Design Analysis Report for the Groundwater Treatment System; 23 Aug 88.

SECTION 8: POST RECORD OF DECISION (CONT.):

Letter to US EPA, from Hanscom AFB Environmental Flight, regarding the Hanscom AFB Area 1 Remedial Investigation Report and the Design Analysis Report for the Groundwater Treatment System; 26 Sep 88.

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding Hanscom's application for a National Pollutant Discharge Elimination System; 3 Nov 88.

Letter to the MA DEQE, from the Hanscom AFB Deputy Base Civil Engineer, regarding design data for a proposed boiler at the groundwater treatment plant; 8 Feb 89.

Letter to the Hanscom AFB Deputy Base Civil Engineer, from the MA DEQE, regarding the application submitted for construction of a new boiler at the groundwater treatment facility; 28 Feb 89.

Letter to Haley & Aldrich, Inc., from Engineering-Science, Inc., regarding a MA DEQE Draft Groundwater Discharge Permit; 24 Apr 89.

Letter to Hanscom AFB Base Civil Engineer, from MA DEQE, regarding Groundwater Discharge Permit No. 0-439; 27 Dec 89.

Memo for record, by Hanscom AFB Environmental Flight, regarding Application for Variance and Environmental Notification Form; 23 Mar 90.

Letter to Hanscom AFB, from US EPA, regarding exclusion from NPDES requirements; 13 Apr 90.

Letter to US EPA, from Hanscom AFB Deputy Base Civil Engineer, regarding the Draft O&M Manual for the groundwater treatment plant; 26 Apr 90.

Letter to MA DEP, from Hanscom AFB Deputy Base Civil Engineer, regarding the Draft O&M Manual for the groundwater treatment plant; 26 Apr 90.

Letter to MA DEP Division of Pollution Control, from Hanscom AFB Deputy Base Civil Engineer, regarding the Draft O&M Manual for the groundwater treatment plant; 26 Apr 90.

Letter to MA DEP, from Hanscom AFB Deputy Base Civil Engineer, transmittal of the Draft O&M Manual; 14 May 90.

Memo for Record, by Hanscom AFB Environmental Flight, regarding Environmental Notification Form and Variance; 13 Jun 90.

Memo for Record, by Hanscom AFB Environmental Flight, containing minutes for the 13 Jun meeting; 14 Jun 90.

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding application requirements for EPA-issued NPDES Permits; 18 Oct 90.

Letter to Hanscom AFB Environmental Flight, from MA DEP, regarding Groundwater Discharge Permit procedures and permit applicability dates; 1991.

Letter to MA DEP, from Hanscom AFB Environmental Flight, transmittal of report concerning OU-1 Groundwater Treatment Facility; 4 Feb 92.

Letter to US EPA, from Hanscom AFB Environmental Flight, transmittal of report concerning OU-1 Groundwater Treatment Facility; 4 Feb 92.

SECTION 8: POST RECORD OF DECISION (CONT.):

Letter to Hanscom AFB Environmental Flight, from MA DEP, regarding OU-1 Groundwater Treatment Facility (Iron Bacteria Remediation); 15 May 92.

Letter to MA DEP, from Hanscom AFB Environmental Flight, transmittal of the Groundwater Treatment Facility Engineering Audit Report for review; 13 Apr 93.

Letter to US EPA, from Hanscom AFB Environmental Flight, transmittal of the Groundwater Treatment Facility Engineering Audit Report for review; 13 Apr 93.

Letter to MA DEP, from Haley & Aldrich, Inc., regarding infiltration testing of the groundwater recharge basins; 21 Apr 93.

Letter to Hanscom AFB Environmental Flight, from MA DEP, regarding the Groundwater Treatment Facility's Engineering Audit Report; 18 Jun 93.

Letter to US EPA, from Hanscom AFB Environmental Flight, transmittal of the Final Report DE Pilot Plan Study for review; 10 Jan 94.

Letter to MA DEP, from Hanscom AFB Environmental Flight, transmittal of the Final Report DE Pilot Plan Study for review; 10 Jan 94.

Letter to Hanscom AFB Environmental Flight, from MA DEP, regarding receipt of the Final Report DE Pilot Plan Study; 21 Mar 94.

Letter to MA DEP, from Hanscom AFB Environmental Flight, regarding Ground Water Discharge Permit Number 0-439; 27 Dec 94.

Letter to Hanscom AFB Environmental Flight, from MA DEP, regarding Groundwater Permit No. 0-439; 30 Dec 94.

Letter to MA DEP (copy to US EPA), from Hanscom AFB Environmental Flight, regarding groundwater discharge from the OU-1 Groundwater Treatment Facility; 14 Jun 95.

Letter to MA DEP (copy to US EPA), from Hanscom AFB Environmental Flight, regarding OU-1 Groundwater Discharge Permit No. 0-439; 27 Jan 97.

Letter to Hanscom AFB Environmental Flight, from IT Corporation, regarding installation of recovery well IW-10 at former Fire Training Area II; 13 Aug 99.

Letter to Hanscom AFB Environmental Flight, from IT Corporation, regarding installation of recovery well IW-5 at former Paint Waste Disposal Area; 18 Aug 99.

SECTION 9: COMMUNITY RELATIONS

DOCUMENTS:

No. 197: *Restoration Advisory Board (RAB) Minutes,* prepared by Hanscom AFB, 29 Nov 94 to present (3 binders).

No. 246: *Restoration Advisory Board Meeting Presentation—Groundwater Monitoring Round 8;* prepared by Haley & Aldrich, Inc., September 1995 (Operable Unit 1).

No. 263: *Restoration Advisory Board 14 May 1996 Presentation Materials;* prepared by CH2M Hill, May 1996.

No. 275: *Restoration Advisory Board Meeting Presentation—Groundwater Monitoring Round 9;* prepared by Haley & Aldrich, November 1996 (Operable Unit 1).

No. 355: *Community Relations Plan for CERCLA (Superfund) Remedial Response Actions and Removal Actions;* prepared by Hanscom AFB; April 1999 (Basewide).

No. 382: *NPL Operable Unit 1 Interim Proposed Plan—Information Meeting and Public Hearing Briefing Slides;* prepared by Hanscom AFB, 28 June 2000 (Operable Unit 1).

CORRESPONDENCE ETC.:

Folder containing articles referring to Hanscom AFB environmental issues; articles date from 29 Apr 82 to present; various sources.

"Making a Good Faith Effort", article featured in Engineering & Services Quarterly; concerning the Installation Restoration Program, winter 82-83.

Memo for Record, by Hanscom AFB Environmental Flight, regarding the Hanscom Field Advisory Committee Meeting; 18 Dec 84.

Talking Paper on Hazardous Waste, Installation Restoration Program, 28 Oct 86.

Minutes of 19 May Hanscom Field Advisory Commission (HFAC) meeting, including briefing on Area 1 RAP's; 19 May 87 (IRP Sites 1, 2, 3/5, and 4).

Hanscom Field Advisory Commission (HFAC) Agenda for 16 June 87 meeting, including briefing on Area 1 RAP's; 16 Jun 87 (IRP Sites 1, 2, 3/5, and 4).

Letter to regulators and other stakeholders, from Hanscom AFB Base Commander, regarding the status of Remedial Action Plans and announcing Public Information Meeting on 30 Jun 87; 22 Jun 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

List of attendees at Public Information Meeting, 30 Jun 87. 87 (Area 1—IRP Sites 1, 2, 3/5, and 4).

Letter to Bedford Minuteman, from MA DEQE, regarding a legal notice concerning the OU-1 Groundwater Treatment System; 4 Apr 89.

Letter to State Secretary, from MA DEQE, regarding public notice of groundwater permit proceedings for the OU-1 Groundwater Treatment System; 4 Apr 89.

Memo for record, by Hanscom AFB Environmental Flight, regarding Application for Variance and Environmental Notification Form for the OU-1 Groundwater Treatment System; 23 Mar 90.

SECTION 9: COMMUNITY RELATIONS (CONT.):

Meeting Notice to stakeholders from MEPA, announcing public review period and informational meeting to be held 13 June 1990 concerning the Application for Variance and Environmental Notification Form for the OU-1 Groundwater Treatment System; 4 Jun 1990

Memo for Record, by Hanscom AFB Environmental Flight, regarding Environmental Notification Form and Variance for the OU-1 Groundwater Treatment System; 13 Jun 90.

Memo for Record, by Hanscom AFB Environmental Flight, containing minutes for the 13 Jun meeting; 14 Jun 90.

Memorandum to Restoration Advisory Board Members, from Hanscom AFB Environmental Flight, regarding the IRP Site Relative Risk Evaluations; 14 Jun 95 (Basewide).

Letter to Assistant Secretary of the Air Force (Environment, Safety & Occupational Health), from Deputy Under Secretary of Defense (Environmental Security); regarding a visit by the Deputy Under Secretary of Defense to Boston and Hanscom AFB; 26 Feb 96.

Letter to Bedford Town Administrator, from RAB member, regarding the current status of Superfund sites in Bedford; 12 Sep 97.

Email to Public Affairs, from Hanscom AFB Environmental Flight, regarding an article published in the Boston Globe; 17 Mar 98.

Letter to Hanscom AFB Environmental Flight, from Town of Bedford Conservation Commission, regarding repairs made in the Hartwell Forest area; 13 May 98.

Letter to Hanscom AFB Environmental Flight, from Town of Bedford Town Administrator, regarding the Federal Facilities Agreement and contamination in a Bedford well; 31 May 00.

"Fact Sheet: Cleaning Up Hanscom AFB Operable Unit 1", bulletin describing recommendations for cleanup of OU-1; Jun 00 (Operable Unit 1).

Letter to Restoration Advisory Board Members, from Hanscom AFB Environmental Flight, regarding the June 28th Informational meeting and Public Hearing for the OU-1 Proposed Plan; 8 Jun 00 (Operable Unit 1).

Letter to Stakeholders, from Hanscom AFB Environmental Flight, regarding the June 28th Informational meeting and Public Hearing for the OU-1 Proposed Plan; 8 Jun 00 (Operable Unit 1).

"Public Comments Being Accepted", Environmental Flight article regarding the Public Review Period and June 28th Informational meeting and Public Hearing for the OU-1 Proposed Plan, appearing in the Hansconian, 9 Jun 00 (Operable Unit 1).

Letter to Restoration Advisory Board Members, from Hanscom AFB Environmental Flight, regarding times for the Public Meeting for IRP Site 6 and OU-1 Proposed Plans, 16 Jun 00 (IRP Site 6; and Operable Unit 1).

Letter to Stakeholders, from Hanscom AFB Environmental Flight, regarding times for the 28 Jun Public Meeting and Hearing; 16 Jun 00 (Operable Unit 1).

SECTION 9: COMMUNITY RELATIONS (CONT.):

Technical Review Committee Documents:

Compilation of letters to stakeholders, from ESC Commander, regarding establishment of the Technical Review Committee (TRC); 22 Feb 93.

Stakeholder responses to 22 Feb letter regarding TRC establishment; various dates; March 93.

Memorandum to members of the TRC, announcing the first meeting; 21 May 93.

Memorandum to US EPA, transmitting Management Action Plan (MAP) and announcing the first meeting of the TRC; 28 May 93.

Minutes of the first TRC meeting, 1 Jun 93.

Memorandum to TRC members, from the Chief, Hanscom AFB Environmental Flight, announcing the second meeting of the TRC; 10 Dec 93.

Minutes of the second TRC meeting, 15 Dec 93.

Restoration Advisory Board (RAB) Documents:

Restoration Advisory Board startup timeline, August 1994.

"Hanscom Air Force Base Seeks Area Residents for Environmental Advisory Group", Hanscom AFB news release regarding solicitation for members, 9 Sep 94.

Restoration Advisory Board membership applications, October 1994.

"Restoration Advisory Board Meeting Set", Hanscom AFB news release regarding the first RAB meeting; 29 Nov 94.

Memorandum to HQ AFMC/CEVR, from Hanscom AFB Environmental Flight, regarding RAB status report; 17 Nov 94.

"Hanscom Board Meets Nov. 29", Hanscom AFB press release regarding the first meeting of the RAB, 29 Nov 94.

Restoration Advisory Board Charter, containing purpose, founding members, objective, etc.; approved 28 Feb 95 at RAB meeting.

SECTION 10: PROGRAM GUIDANCE

DOCUMENTS:

No. 257: *Base Comprehensive Plan, Vol. I and II;* prepared by Benham GP, September 1991 (Basewide).

No. 148: *Hanscom AFB's Initial Management Action Plan (MAP);* prepared by Radian Corporation; December 1992 (Basewide).

No. 222: *Management Action Plan (MAP)—Fiscal Year 1993;* prepared by Hanscom AFB; December 1992 (Basewide).

No. 223: *Management Action Plan (MAP)—Fiscal Year 1994;* prepared by Hanscom AFB; December 1993 (Basewide).

No. 224: *Management Action Plan (MAP)—Fiscal Year 1995;* prepared by Hanscom AFB; January 1995 (Basewide).

No. 356: *Management Action Plan (MAP)—Fiscal Year 1999;* prepared by Hanscom AFB, April 1999 (Basewide).

No. 125: *U.S. Air Force Restoration Program Remedial Project Manager's Handbook;* prepared by HQ USAF/ILEVR, revised 2000.

CORRESPONDENCE:

Letter to Hanscom AFB Environmental Flight, from the Deputy Director, Environmental Protection, regarding Public Affairs guidance for upcoming records searches for possible hazardous material sites; 20 Mar 81.

Memorandum of Understanding between the Department of Defense and the Environmental Protection Agency clarifying each agency's responsibilities with regards to response actions; 12 Aug 83.

Letter to Hanscom AFB Environmental Flight, from the Massachusetts Department of Environmental Quality Engineering, regarding IRP Fast-Track efforts; 5 Nov 85.

Letter to Hanscom AFB Environmental Flight, from MA DEQE, regarding groundwater contamination at Hanscom; 28 Apr 86.

Letter to Hanscom AFB Civil Engineering Squadron, from MA DEQE, regarding HAFB Base Studies; 21 Aug 86.

Letter to Hanscom AFB Base Commander, from US EPA, requesting scheduling of a meeting regarding the EPA's and Hanscom's roles as defined by the Superfund Act; 29 May 87.

Memo for record, from Hanscom AFB Environmental Flight, regarding the IRP update and a review meeting with MA DEQE; 6 Jul 88.

Letter to Hanscom AFB Civil Engineering, from MA DEQE, regarding the Hanscom Field/Hanscom AFB Massachusetts Contingency Plan/IRP Stage 2; 26 Oct 89 (IRP Sites 1 through 13).

Letter to Hanscom AFB Environmental Flight, from MA DEP, regarding sites contained on the 1993 Transition List; 23 Jul 93.

SECTION 10: PROGRAM GUIDANCE (CONT.):

Letter to Headquarters Air Force Materiel Command, from SAF/MIQ, regarding the proposed placement of Hanscom AFB on the NPL; 31 May 1994.

Letter to the Deputy Undersecretary of Defense (Environmental Security), from Air Force Materiel Command, regarding Hanscom AFB's status on the NPL; 14 Jun 1994.

Letter to 647 Air Base Group/Environmental Flight, from Headquarters Air Force Materiel Command, regarding expedited NPL cleanup; 17 Jun 1994.

Letter to the Chief, Environmental Flight, from the Commonwealth of Massachusetts Department of Environmental Protection (also signed by US EPA), regarding Hanscom AFB's placement on the NPL; 18 Aug 1994.

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding determination of sites to be regulated by the EPA; 13 Jan 95.

Letter to the Hanscom AFB Environmental Flight, from US EPA, regarding the Scope of Work for the basewide Wetlands/Endangered Species/Archaeological Study at Hanscom; 18 Jan 95.

Consensus Statement #1 between the US Environmental Protection Agency, the MA Department of Environmental Protection, and Hanscom AFB, regarding the institution of Consensus Statements to document decisions; 22 Feb 95 (all IRP sites).

Consensus Statement #3 between the USEPA, MADEP, and Hanscom AFB, regarding the division of contaminated areas within Hanscom AFB into Operable Units; 7 Mar 1995 (OU-1, OU-2, OU-3, and OU-4).

Letter to the Hanscom AFB Environmental Flight and the Naval Facilities Engineering Command, from US EPA, requesting that the AF and the Navy formally share environmental data; 17 Apr 95.

Letter to Hanscom AFB Environmental Flight and the Naval Facilities Engineering Command, from US EPA, regarding data use at HAFB and NWIRP Superfund sites; 21 Apr 95.

Letter to US EPA, from CH2M Hill, regarding data quality objectives for Human Health and Ecological Risk Assessments; 24 Apr 95.

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding data quality objectives for the Human Health and Ecological Risk Assessment; 8 May 95.

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding the Restoration Advisory Board meeting on 23 May 95; 6 Jun 95.

Consensus Statement #6 between the USEPA, MADEP, and Hanscom AFB, regarding the removal of IRP Site 13 from OU-4 and site organization information, 7 Sep 1995 (all IRP sites).

Letter to Hanscom AFB Environmental Flight, from MA DEP, regarding Tier 1 Disposal Sites; 2 Jun 97.

Letter to Hanscom AFB Environmental Flight, from US EPA, regarding project scheduling; 1 Oct 97.

Letter to the Bureau of Waste Site Cleanup, MA Department of Environmental Protection, from the United States Environmental Protection Agency, requesting Groundwater Use and Value Determination at Hanscom AFB; 15 Sep 1998.

SECTION 10: PROGRAM GUIDANCE (CONT.):

Letter to the United States Environmental Protection Agency, from the MA Department of Environmental Protection, regarding Groundwater Use Determination at the Hanscom AFB Superfund site; 15 Oct 1998.

SECTION 11: NOT USED

SECTION 12: REFERENCES FROM NON-HANSCOM AFB SITES

DOCUMENTS:

Bedford Sites:

No. 269: *Hydrology Reports and Notes, Hartwell Road et al.*; prepared by various authors, 1983-1985.

No. 2: *Bedford's Hartwell Road Wellfield Contamination Study, Phase II*; prepared by CDM, August 1984.

No. 68: *Work Plan for RI for the Hartwell Road Wellfield, Bedford*; prepared by GEI Consultants, February 1990.

No. 90: *Groundwater Elevations Measurements and Boring Logs*; prepared by GEI Consultants, January 1991.

No. 96: *Chemical Data, Hartwell Road Remedial Investigation, 2 Volumes*; prepared by GEI Consultants, April 1991.

No. 110: *Hartwell Road Wellfield Remedial Investigation, Boring Logs et al.*; prepared by GEI Consultants, August 1991.

No. 115: *Draft Remedial Investigation Report, Hartwell Road Wellfield, Vol. 1 through 5 (7 books);* prepared by GEI Consultants, September 1991.

No. 114: *Draft Feasibility Study Report, Hartwell Road Wellfield*, prepared by CDM, November 1991.

Draper Lab Sites:

No. 113-1: *Limited Site Investigation, Draper Lab Special Test Facility*; prepared by GZA, September 1990.

No. 113-2: *Soil Excavation Activities Report, Draper Lab Special Test Facility*; prepared by Zecco, August 1991.

MassPort Sites:

No. 235-A: *Phase 1: Limited Site Investigation for FAA Hanger Fuel Storage Area*; prepared by Metcalf & Eddy, May 1993.

No. 235-B: Supplemental Phase I Investigation—FAA Hanger Fuel Storage Area RT 3-4467; prepared by GEI Consultants, June 1995.

SECTION 12: REFERENCES FROM NON-HANSCOM AFB SITES (CONT.):

NWIRP Sites:

No. 61: *Initial Assessment Study of Naval Weapons Industrial Reserve Plant; Bedford*; prepared by Rogers, et al., November 1985.

No. 63: *Remedial Investigation Work Plan for Naval Weapons Industrial Reserve Plant, Bedford*; prepared by Dames & Moore, January 1989.

No. 62: *Community Relations Plan for Naval Weapons Industrial Reserve Plant, Bedford*; prepared by Dames & Moore, February 1989.

No. 64: *Remedial Investigation Findings for Naval Weapons Industrial Reserve Plant, Bedford*; prepared by Dames & Moore, November 1989.

No. 65: *Revised Remedial Investigation Findings for Naval Weapons Industrial Reserve Plant, Bedford;* prepared by Dames & Moore, February 1990.

No. 81: *Supplemental to RI Findings for Naval Weapons Industrial Reserve Plant, Bedford*; prepared by Dames & Moore, July 1990.

No. 133: *Naval Weapons Industrial Reserve Plant, Phase II RI Work Plan*; prepared by ENSR, May 1992.

No. 134: *Naval Weapons Industrial Reserve Plant, Phase II RI Sampling and Analysis Plan*; prepared by ENSR, May 1992.

No. 214: *Short Term Measure Design Plan of Action/Work Plan*; prepared by Halliburton NUS, May 1992.

No. 169: *Community Relations Plan for Naval Weapons Industrial Reserve Plant, Bedford*; prepared by Halliburton NUS, November 1992.

No. 251: *RI—Phase II Report, Naval Weapons Industrial Reserve Plant, 2 Volumes*; prepared by Halliburton NUS, October 1994.

No. 388: *Supplemental Investigation Report—Southern Flight Test Area, NWIRP Bedford*; prepared by Tetra-Tech NUS, February 1999.

Raytheon Site:

No. 10: *Preliminary Environmental Assessment, Raytheon Systems Laboratory*; prepared by GZA, September 1987.

No. 11: *Raytheon's Tank Assessment, Raytheon Systems Laboratory;* prepared by GZA, November 1987.

No. 66: *Geohydrologic Study, Raytheon Systems Laboratory, Volume I*; prepared by GZA, December 1988.

No. 67: *Geohydrologic Study, Raytheon Systems Laboratory, Volume II*; prepared by GZA, December 1988.

Virginia Road Site:

No. 12: *Site Assessment Summary, 696 Virginia Road Concord and G474*; prepared by Rizzo Assoc., April 1986.

Appendix B – Responsiveness Summary

Responsiveness Summary

Installation Restoration Program
Hanscom Air Force Base
Operable Unit-1

Overview

Following completion of the Focused Feasibility Study (FFS) for Operable Unit 1 (OU-1), Hanscom Air Force Base (AFB), identified a preferred remedial action for the site which was provided to the public for comment in the Interim Proposed Plan (PP). The interim preferred alternative involves continued operation of the existing groundwater recovery and treatment system, continuing to look for effective measures to reduce source area contamination in order to expedite groundwater cleanup, continuing the monitoring program, and implementation of institutional controls.

This Focused Feasibility Study/Interim Proposed Plan updates the Remedial Action Plans (RAPs) finalized in 1987 for Installation Restoration Program (IRP) Sites 1, 2 and 3/5 which included Removal Actions at Sites 1, 2 and 3 and the construction of a groundwater collection, treatment and recharge system to address the groundwater contamination in the area now designated as Operable Unit 1. This system has operated continuously since its start-up in 1991.

Judging from the limited number of comments received during the public comment period, it appears the community supports the proposed remedial alternative for OU-1.

Background on Community Involvement

The Massachusetts Department of Environmental Protection (MADEP) is aware of the nature of the proposed remedial alternative for OU-1, and has been involved in reviewing the original RAPs, subsequent supplemental investigations and the focused feasibility study reports and planning efforts. The community has been kept advised of the OU-1 conditions through regular meetings of a Technical Review Committee (TRC) established in 1993 which was subsequently converted/expanded to a Restoration Advisory Board (RAB) which includes residents of the surrounding communities. The RAB was established in 1994 and has been meeting regularly with updates and discussions related to OU-1 investigations and remedial action planning. The RAB meetings have been open to the public, and notices have been published in local newspapers identifying the date, time, and location of the meetings.

The public comment period for the OU-1 Interim Proposed Plan was from June 9, 2000 to July 10, 2000. In addition, a public meeting and a public hearing were conducted on June 28, 2000 in Bedford, MA to discuss the OU-1 Interim Proposed Plan.

Summary of Public Comments Received During Public Comment Period and Agency Responses

During the public hearing oral comments were accepted from the public. No oral and/or written comments were received during the comment period, including the public hearing.

Remaining Concerns

Hanscom AFB is not aware of any concerns that were unable to be addressed during the public comment period.

Attachment A

Community Relations Activities

Community relations activities conducted for OU-1, Hanscom AFB:

- Briefings periodically conducted at Hanscom Field Advisory Commission meetings in early 80's during the Preliminary Assessment/Site Inspection phases.
- Significant newspaper coverage of Hanscom AFB's Preliminary Assessment/Site Inspection/Remedial Action Plan status in the 80's.
- June 30, 1987 letter to regulators and other stakeholders providing status of Remedial action Plans for Sites 1 through 5 and announcing a public informational meeting on.
- Public informational meeting on the Remedial Action Plans for Sites 1 through 5 held June 30, 1987.
- MEPA request Legal Notice be placed in Bedford Minuteman concerning Hanscom AFB's groundwater water discharge permit application (April 4, 1989)
- On April 4, 1989 MEPA requested that the State Secretary published in the Central Register the public notice for a groundwater discharge permit determination.
- Copy of Application for Variance and Environmental Notification Form sent to regulators and other stakeholders (March 21, 1990)
- MEPA June 4, 1990 notice of consultation session on June 13, 1990 to receive comments from regulators and other stakeholders on Hanscom AFB's groundwater remediation.
- Consultation session on Hanscom AFB's groundwater remediation held on June 13, 1990.
- TRC meetings conducted June 1, 1993 and 15 December 15, 1993
- RAB meetings conducted from November 29, 1994 to present with Public Notices proceeding each meeting.
- Project Team (Hanscom AFB, USEPA & MA DEP) meeting on May 18, 2000 with Bedford Town Officials to discuss the Proposed Plans for OU-1 and OU-3/Site 6, the Federal Facility Agreement currently being established between Hanscom AFB and USEPA, and the situation concerning monitoring well RAP1-7 in the Bedford Community Gardens.
- Information Repositories were established at the Bedford and Concord Town Libraries during the Public Comment Period (June-July, 2000)
- Public Notices for public meeting and hearing published in local and Hanscom AFB newspapers (June 8, 2000)
- Fact Sheet – Cleaning Up Hanscom AFB Operable Unit 1 and information on public comment period, public meeting and hearing sent to RAB mailing list (June 8, 2000)
- Proposed Plan, Fact Sheet and information on public comment period, public meeting and hearing sent to Bedford and Concord (Town Manager, Board of Health & Conservation Commission), and Massport (Hanscom Field Manager & Environmental Unit) (June 8, 2000)
- Public Comment Period from June 9 to July 10, 2000.
- Public meeting held at Bedford Town Hall on June 28, 2000 to describe RI/FS reports and Interim Proposed Plan, and to respond to questions from the public.

- Public hearing held at Bedford Town Hall on June 28, 2000 to record comments by the public.
- The Administrative Record is maintained at Hanscom AFB and is available for review by the public.

Attachment B

Public Hearing Transcript

COMMONWEALTH OF MASSACHUSETTS
TOWN OF BEDFORD

ORIGINAL

****
PUBLIC HEARING RE:)
)
HANSCOM AIR FORCE BASE)
NPL OPERABLE UNIT 1)
INTERIM PROPOSED PLAN)
****

BEFORE: Thomas Best, Hearing Officer

Bedford Town Hall
Mudge Way
Bedford, Massachusetts
Wednesday, 28 June, 2000
8 p.m.

P R O C E E D I N G S

HEARING OFFICER BEST: We are now starting the public hearing portion of the meeting, and the official record is now open. My name is Thomas Best, and I will be the Hearing Officer tonight.

The purpose of the hearing is to accept oral comments, testimony, and written comments on the Interim Proposed Plan for the areas on Hanscom Field identified as Operable Unit 1 for which the Air Force has accepted responsibility to clean up.

All comments and testimonies that are given tonight will be transcribed verbatim and become part of the official record on this project. Each and every comment will be responded to in the response in the Responsiveness Summary that will be issued at the close of the public comment period.

The Responsiveness Summary will be attached to the interim record of decision. The record of decision will contain the Air Force's selected alternative for Operable Unit 1 and rationale for the selection.

This hearing is different from the informational meeting held earlier. It is

exclusively for listening to and recording your comments, your oral comments. We will not respond to your comments during the hearing unless you need clarification on something. We may ask you for clarification if we are not sure what your comment is. Everyone wanting to comment will be given the opportunity to do so. Please speak up so that everyone present can hear. If you want a copy of the Responsiveness Summary mailed to you when it is issued, please state your name and mailing address. If you do not want a copy of the responsiveness summary, just state your name and residence.

The floor is now open for comment on Interim Proposed Plan for Hanscom Air Force Base Operable Unit 1.

(There were no comments from the floor.)

HEARING OFFICER BEST: Are there any further comments to be offered on the Interim Proposed Plan for Hanscom Air Force Base's Operable Unit 1?

If there is no further comment to be made, then I shall now close the official record for oral testimony. The record is now closed.

Please note that you can still

provide written comments through July 10th. I thank you all for coming, and have a good evening.

(Whereupon the hearing adjourned at

8:05 p.m.)

CERTIFICATE

I, Patricia Jodi Ohnemus, Certified Shorthand Reporter do hereby certify that the foregoing transcript Pages 1 through 4 is a true, accurate and complete transcript of my stenotype notes taken to the best of my knowledge, skill and ability.

Patricia Jodi Ohnemus

Patricia Jodi Ohnemus

Appendix C – Cost Tables

COST ESTIMATE FOR ALTERNATIVE G-3
GROUNDWATER COLLECTION, TREATMENT, AND RECHARGE SYSTEM
HANSCOM AIR FORCE BASE OU-1 SITE

Date: 03-Nov-00

Long-Term Monitoring & Operation and Maintenance (O&M) Costs

ITEM DESCRIPTION (Annual Activities)	UNITS	QUANTITY	UNIT COST			TOTAL COST (&)
1.0 LTM/O&M Contractor	Lumpsum	1	312,000			312000
2.0 Electricity	Lumpsum	1	66,000			66000
3.0 Propane	Lumpsum	1	24,000			24000
4.0 Other O&M	Lumpsum	1	23,000			23000
5.0 Other Sampling	Lumpsum	1	25,000			25000
6.0 VER Carbon	Lumpsum	1	10,000			10000
7.0 Computer System O&M	Lumpsum	1	7,000			7000
8.0 Sludge Disposal	Lumpsum	1	3,200			3200
9.0 Ecological Sediment Surface Water Sampling (2 sampling rounds)						
Field Crew (2-person)	days	4	1,200			4,800
Sampling Expenses (Field Equipment, Travel)	days	4	400			1,600
Laboratory Analysis (Pb, Cu, AVS/SEM)	each	24	250			6,000
10.0 Ecological Assessment Report (one report only)	LS	1	6,000			6,000

Total Annual Cost (Year 1)	$	488,600
Year 1 Contingency (20%)	$	97,720
Year 1 Subtotal	$	586,320
Total Annual Cost (Year 2-30)	$	470,200
Years 2-30 Contingency (20%)	$	94,040
Year 2-30 Subtotal	$	564,240
Present Worth Annual O&M (30-yrs, i=5%)	$	8,543,199
Total Present Worth O&M	$	9,129,519

5 Year Site Reviews

ITEM DESCRIPTION (Annual Activities)	UNITS	QUANTITY	UNIT COST ($)			TOTAL COST (&)
11.0 5 Year Site Reviews	Lump sum	1	20000			20000

Total 5-year Cost	$	20,000
Contingency (25%)	$	5,000
Subtotal	$	25,000
Present value of series of 6 intervals of 5 years(30yr, i=5%)	$	69,551
Total Present Worth O&M	$	69,551

TOTAL PRESENT WORTH COST (from above) $ 9,199,070

Comments

Other O&M includes solvent disposal, acid wash of towers, cleaning recharge piping, carbon disposal, clean and repack towers.
Other Sampling includes GW VOCs, GW lead, VER effluent air, and pigging sludge disposal analyses.

Appendix D – ARAR Tables

Summary of Primary COCs by Media
Hanscom AFB OU1

Media	*Primary COC*	*Potential Receptor*
Surface water	inorganics	Ecological
Groundwater	VOCs	Human

APPENDIX D

Hanscom AFB OU-1 *Existing Dynamic Groundwater Collection and Treatment System, Institutional Controls and Monitoring* **ARARs**

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Chemical Specific ARARs				
Groundwater	***Federal***			
	Federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs) (40 CFR 141.11-141.16)	MCLs are enforceable standards that regulate the concentration of specific organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supplies. They also may be considered relevant and appropriate for groundwater aquifers potentially used for drinking water. Primary threat COCs in groundwater are VOCs.	The groundwater remediation system will treat extracted groundwater to attain MCLs before discharging the treated groundwater to the recharge basins and drainage ditch. The standards will not be attained within the contaminated plume in the short-term. An interim remedy waiver will be obtained in accordance with CERCLA 121 (d)(4)(A). The selected remedy includes annual groundwater and surface water monitoring in order to track changes in contaminant concentrations over time. MCLs are listed in Table 2-1 for compounds of concern at OU-1.	Relevant and Appropriate
	Federal Safe Drinking Water Act Maximum Contaminant Level Goals (MCLGs) (40 CFR 141.50-141.51)	Non-zero MCLGs are nonenforceable health goals for public water systems. MCLGs are set at levels that would result in no known or expected adverse health effects with an adequate margin of safety. Non-zero MCLGs are to be used as goals when MCLs have not been established for a particular compound of concern.	The groundwater remediation system will treat extracted groundwater to attain MCLGs before discharging the treated groundwater to the recharge basins and drainage ditch.The standards will not be attained in the contaminated plume in the short-term. An interim remedy waiver will be obtained in accordance with CERCLA 121(d)(4)(A). The selected remedy includes annual groundwater and surface water monitoring in order to track changes in contaminant concentrations over time. MCLGs are listed in Table 2-1 for compounds of concern at OU-1.	Relevant and Appropriate
	State			
	Massachusetts Drinking Water Standards (310 CMR 22.00)	These standards establish State MCLs for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water systems. They are to be used where they are more stringent than Federal MCLs.	The groundwater remediation system will treat extracted groundwater to attain State MCLs before discharging the treated groundwater to the recharge basins and drainage ditch.The standards will not be attained in the contaminated plume in the short-term. An interim remedy waiver will be obtained in accordance with CERCLA 121(d)(4)(A). The selected remedy includes annual groundwater and surface water monitoring in order to track changes in contaminant concentrations over time. State MCLs are listed in Table 2-1 for compounds of concern at OU-1.	Relevant and Appropriate
	Massachusetts Contingency Plan (MCP) Method 1 GW-1 Standards (310 CMR 40.0974)	These are promulgated standards for characterizing the risk posed by COCs in groundwater under the MCP. The MCP Method 1 GW-1 standards will only apply for compounds where the standard is more restrictive than the federal MCL or MCLG, or for which no MCL or MCLG currently exists. Primary threat COCs in groundwater are VOCs.	The groundwater remediation system will treat extracted groundwater to attain MCP Method 1 GW-1 standards before discharging the treated groundwater to the recharge basins and drainage ditch. The standards will not be attained within the contaminated plume in the short-term. An interim remedy waiver will be obtained in accordance with CERCLA 121 (d)(4)(A). The selected remedy includes annual groundwater and surface water monitoring in order to track changes in contaminant concentrations over time. MCP Method 1 GW-1 standards are listed in Table 2-1 for compounds of concern at OU-1.	Relevant and Appropriate
Location Specific ARARs				
Surface water and wetlands	***Federal***			
	Fish and Wildlife Coordination Act (16 USC 661 et seq.)	This act requires consultation with the Fish and Wildlife Service and the state wildlife resource agency if alteration of a body of water, including discharge of pollutants into a wetland, will occur as a result of off-site remedial activities. Consultation is strongly recommended for on-site actions. This provides protection for actions that would affect streams, wetlands, other water bodies or protected habitats. Any action taken should protect fish or wildlife, and include measures developed to prevent, mitigate, or compensate for project-related losses to fish and wildlife.	The selected remedy includes continued operation of the groundwater remediation system and the long-term monitoring of groundwater and short-term monitoring of surface water and sediments. Precautions will be taken to minimize the potential effect on fish and wildlife during these activities.	Relevant and Appropriate
Wetland sediment and surface water	***Federal***			
	Protection of Wetlands - Executive Order 11990 (40 CFR 6, Appendix A)	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of the Protection of Wetlands Executive Order. Under this order, federal agencies are required to minimize the degradation, loss, or destruction of wetlands, and to preserve the natural and beneficial values of wetlands. Appendix A requires that no remedial alternatives adversely affect a wetland if another practicable alternative is available. If no alternative is available, effects from implementing the chosen alternative must be mitigated.	The selected remedy includes continued operation of the groundwater remediation system and the long-term monitoring of groundwater and short-term monitoring of surface water and sediments. No additional actions, other than monitoring, are proposed in the wetlands. No practicable alternative to these remedy components exists. Precautions will be taken to minimize the potential effect on wetlands during these activities.	Applicable

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Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Wetland sediment and surface water	***State***			
	Massachusetts Wetlands Regulations (310 CMR 10.51-10.60, MGL c. 131, Section 40: Wetlands Protection Act)	These regulations protect inland wetlands such as those found at the site from activities that may alter the resource area. The loss may be permitted with replication of the lost area within two growing seasons.	The selected remedy includes continued operation of the groundwater remediation system and the long-term monitoring of groundwater and short-term monitoring of surface water and sediments. No additional actions, other than monitoring, are proposed in the wetlands. Activities at the site will be performed in compliance with the performance standards of these regulations.	Applicable
Other Natural Resources	***Federal***			
	Protection of Floodplains, Executive Order 11988 (40 CFR 6, Appendix A)	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of the Protection of Floodplains Executive Order. Under this order, federal agencies are required to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values of the floodplain.	According to the Comprehensive Ecological Analysis (LEC, August 1997), portions of OU-1 are located within a 100-year floodplain. The selected remedy includes continued operation of the existing groundwater remediation system, and the long-term monitoring of groundwater and the short-term monitoring of surface water and sediment. No practicable alternative to these remedy components exists. The floodplain storage capacity and hydraulics will not be changed by this remedy.	Applicable
	State			
	Massachusetts Endangered Species Act, 321 CMR 10.00, (MGL c. 131A)	The Commonwealth of Massachusetts has authority to research, list, and protect any species deemed endangered, threatened, or of other special concern. These species are listed as either endangered, threatened, or species of special concern in the regulations. Actions must be conducted in a manner that minimizes the effect on Massachusetts-listed endangered species and species listed by the Massachusetts Natural Heritage Program.	According to the Massachusetts Natural Heritage Atlas (2000-2001), portions of OU-1 have been designated as Priority Habitats of Rare Species. The selected remedy includes continued operation of the groundwater remediation system and the long-term monitoring of groundwater and the short-term monitoring of surface water and sediment. Precautions will be taken to minimize the potential effect on endangered species.	Applicable
Action Specific ARARs				
Surface water	***Federal***			
	Clean Water Act National Pollutant Discharge Elimination System (NPDES) Regulations (40 CFR 122-125 and 131)	These regulations establishe discharge limitations, monitoring requirements and best management practices for any direct discharge from a point source into surface water.	The selected remedy includes continued operation of the groundwater remediation system, which includes the discharge of effluent from the treatment plant to a drainage channel. The effluent will be sampled and analyzed to ensure compliance with regulatory discharge parameters.	Applicable
	Federal Ambient Water Quality Criteria (AWQC), 33 U.S.C 1314(a); (40 CFR Part 122.44)	Federal AWQC include (1) criteria for protection of human health from toxic properties of contaminants ingested through drinking water and aquatic organisms, and (2) criteria for protection of aquatic life.	Contaminant concentrations in the Wetland B/Beaver Pond Area surface water will be measured during short-term monitoring to determine whether water quality is being impacted by contaminated groundwater migrating from the upper aquifer, and to assure that AWQC are being met.	Relevant and Appropriate
	State			
	Clean Waters Act - Surface Water Discharge Permit Program (314 CMR 3.00; MGL c. 21 Sections 26-53)	This act and program establish the requirements intended to maintain the quality of surface waters by controlling the direct discharge of pollutants to surface waters. Direct discharges of wastewater to surface waters must meet effluent discharge limits established by this program.	The selected remedy includes continued operation of the groundwater remediation system, which includes the discharge of effluent from the treatment plant to a drainage channel. The effluent will be sampled and analyzed to ensure compliance with regulatory discharge parameters.	Applicable
	Massachusetts Surface Water Quality Standards (314 CMR 4.05(3)(b)5-8; MGL c.21 Sections 26-53)	These regulations limit or prohibit discharges of pollutants to surface waters to assure that surface water quality standards of the receiving waters are protected and maintained or attained. Discharges may be limited or prohibited to protect existing uses and not interfere with the attainment of designated uses in downstream and adjacent segments. This may pertain to both discharges to surface water as a result of remediation and any onsite surface waters affected by site conditions.	Contaminant concentrations in the Wetland B/Beaver Pond Area surface water will be measured during short-term monitoring to determine whether water quality is being impacted by contaminated groundwater migrating from the upper aquifer, and to assure that Massachusetts Surface Water Quality Standards are being met.	Relevant and Appropriate
Groundwater	***Federal***			
	Resource Conservation and Recovery Act (RCRA) 40 CFR Part 264, Subpart F-Releases from Solid Waste Management Units (40 CFR 264.90-264.101 and 265.90-265.94)	General facilities requirements for groundwater monitoring at affected facilities and general requirements for corrective action programs, if required, at the affected facilities.	Groundwater monitoring will be conducted in accordance with these requirements.	Relevant and Appropriate

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Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Groundwater	***State***			
	MA Hazardous Waste Management Rules (HWMR) Groundwater Protection (310 CMR 30.660-30.679)	These regulations require groundwater monitoring at specified regulated units that treat, store or dipose of hazardous waste. Maximum concentration limits for the hazardous constituents are specified in 310 CMR 30.668.	Groundwater monitoring will be conducted in accordance with these requirements.	Relevant and Appropriate
	MA Standards for Analytical Data for Remedial Response Action, Bureau of Waste Site Cleanup Policy 300-89	This policy decribes the minimum standards for analytical data submitted to the MADEP.	All sampling plans will be designed with consideration of the analytical methods provided in this policy.	To Be Considered
	Massachusetts Groundwater Discharge Permit Program (314 CMR 5.00; MGL c.21 Sections 26-53)	This program is designed to protect state groundwaters for their highest potential use by regulating discharges of pollutants to state groundwaters and requiring the MADEP to regulate the outlets for groundwater discharges and associated treatment works. These regulations set effluent limits for the discharge of pollutants to groundwater. Recharge wells used exclusively to replenish an aquifer with uncontaminated water are exempt from this requirement. Uncontaminated water is water which upon discharge could not cause a violation of applicable water quality standards.	The selected remedy includes continued operation of the groundwater remediation system, which includes the potential discharge of treated water to the ground via recharge basins. Discharge of treated water to groundwater would comply with the substantive requirements of these regulations.	Relevant and Appropriate
Waste	***Federal***			
	RCRA Identification and Listing of Hazardous Wastes (40 CFR 261.24)	These requirements establish the maximum concentrations of contaminants for which the waste would be a RCRA-characteristic hazardous waste for toxicity.	The selected remedy includes continued operation of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. These materials potentially include the activated carbon from the vacuum enhanced recovery system and the waste byproduct from the groundwater treatment plant. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	RCRA Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262)	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations.	The selected remedy includes continued operation of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. These materials potentially include the activated carbon from the vacuum enhanced recovery system and the waste byproduct from the groundwater treatment plant. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	State			
	MA HWMR, Use and Management of Containers, 310 CMR 30.689; Storage and Treatment in Tanks, 310 CMR 30.699	These regulations set forth requirements for use and management of containers and tanks at hazardous waste facilities.	Packing and accumulation of treatment sludges and other materials will adhere to these standards.	Relevant and Appropriate
	Massachusetts Hazardous Waste Management Rules (HWMR), 310 CMR 30.300-30.371, Requirements for Generators	Establishes requirements and standards for generators of hazardous waste that address general waste management measures, including the accumulation of hazardous waste prior to off-site disposal, preparing the hazardous wastes for shipment, and preparing appropriate waste manifests.	The selected remedy includes continued operation of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Relevant and Appropriate